Oregon, Public Schools of.

State Manual of the Course of Study in Agriculture, 1914.

Course of Study
in
Agriculture
for the
Public Schools
of
Oregon

State Department of Education
1914-15

STATE MANUAL

OF THE

Course of Study in Agriculture

FOR THE

PUBLIC SCHOOLS OF OREGON

ISSUED BY THE

STATE DEPARTMENT OF EDUCATION

J. A. CHURCHILL
Superintendent of Public Instruction
1914

SALEM, OREGON:
STATE PRINTING DEPARTMENT
1914

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A Course in the Elements of Agriculture for the Rural and Graded Schools of Oregon

The work outlined in this circular is intended to satisfy the demands of teachers and school patrons for a year's course in the elements of agriculture which will be broad enough to include the varied agricultural activities of our great commonwealth and elastic enough to enable its subject matter to be interpreted in terms of local community experience.

It would be undesirable to formulate a course in agriculture that must be followed rigidly by every school in every county and it would be very difficult to devise a course that would meet the needs of every school district. There is need, however, of at least an outline, so that there may be some uniformity in both the contents of the course and in the methods employed throughout the State.

This course should be considered as preliminary to the next one, which will be more complete and which will appear later. Superintendents and teachers are urged to offer criticisms and suggestions so that the revised outline will approximate the ideal of what such a course should be.

The subject matter and the methods suggested in this course are based upon certain fundamental principles believed to be correct agriculturally and sound pedagogically. These may be stated as follows:

1. Agriculture should be taught, as far as possible, in terms of the child's own experience. This centers the work of the school around the dominant interests and activities of the home and the community.

2. There should be a seasonal rather than a logical sequence in the presentation of topics; *i. e.*, the activities of the home, farm and community are to be studied as they are naturally occurring, not months before or after.

3. The mechanics of class-room instruction make it desirable, if not necessary, so to arrange the work in agriculture that there will be definite exercises or lessons outlined for each school day. Opportunity is thus given to arrange the subject matter into a series of lesson topics and subtopics so that they may be studied in seasonal and sequential order.

4. When there is in the home or community an agricultural industry whose activities run more or less throughout the year, like dairying, fruit-growing, poultry-keeping, etc., such industry should be made the backbone of the course.

5. All laboratory work should demonstrate some point or topic under consideration in class. These exercises should exemplify the practical rather than the theoretical points at issue, and the results should be interpreted in terms of home and farm application rather than in terms of pure science.

6. Students manifesting a great deal of interest in agriculture should be encouraged to apply their knowledge at home. That phase of agriculture most attractive to them should be organized into a definite project to be worked out at home under the supervision of the school. The Boys' and Girls' Club movement provides the means and methods for such study and supervision.

7. All of the other school subjects may be vitalized and greatly strengthened by teaching them in terms of agriculture. Agricultural booklet-making provides an effective method for such correlation.

SUGGESTIONS TO TEACHERS

a. You are to be the class leader rather than the instructor. Place the burden of discussion upon the pupils. Every student coming from a farm home, and often from a city home, is brimful of facts, ideas and suggestions gained by intimate contact with the soil, plants, animals, fields and woods. Seek only to find those things of greatest interest to the boys or girls; apply the proper suggestion, or ask a thought-stimulating question and let them tell or do, however crude they may be at first in thus expressing themselves. Telling and doing rather than reciting is the ideal for classroom work in agriculture.

b. Do not feel ashamed if your pupils know some facts about the farm or fields not possessed by yourself. Let them glory in telling you and the class what they know. Expression rather than impression is the result desired and the best informed teacher may easily become the poorest by monopolizing the class discussion.

c. Do not depend upon the text as the only source of information. Have the pupils consult the Government and Agricultural College publications, which should form part of the

school's permanent library; the farm papers, which can be obtained from the student's homes, and the agricultural books in the school, county and State libraries.

d. Plan the work far enough in advance that the references given in connection with each topic can be procured. Encourage the pupils to consult their parents, practical farmers, or others in the community, for information concerning the topic studied. Whenever possible, go with them on a field trip to an orchard, farm, creamery, etc. Such trips will vitalize the classroom work and furnish material to use in connection with the other school subjects. Written reports, discussions and debates instead of recitations and written examinations, will lighten the burdens of the teacher and increase the interest of the pupils.

e. If you desire agricultural information or wish to encourage some special agricultural activity in your community, consult your County Agriculturalist or write to the Extension Service, Oregon Agricultural College. The Extension Service is making a special effort to help teachers apply their agriculture in terms of their own community needs.

f. Encourage those pupils who are most interested in agriculture to undertake an Industrial Club project. Through the practical work of these clubs, the teacher can reach the parents and people of the community most effectively.

HOW TO USE THE OUTLINE

The course as outlined contemplates an intensive study of agriculture in the eighth grade only. It is assumed that 20 to 30 minutes will be available each day for the necessary reports, discussions, exercises and demonstrations.

Do not follow the outline too rigidly. Whenever you feel that the pupils will be more interested in some agricultural topic other than the one assigned, permit them to study that subject as long as they can do so with profit. More work is outlined for each week than the majority of schools can cover. The teacher's task will be that of judiciously selecting the material and directing the interests of the pupils.

A distinction has been made between an exercise and a demonstration. An exercise is a practical, objective lesson performed either indoors or out, requiring the active participation of every pupil, while a demonstration is an exercise

which may be performed by one person or by a group for the benefit of the class. A demonstration also differs from an exercise in that it usually requires more equipment or a longer period of time for its completion.

At least one exercise or demonstration, illustrating the topic under consideration at the time, should be performed each week. Suggestions and directions for these exercises are given in this circular.

The subtopics listed as a, b, c, etc., are suggested for daily lesson subjects. Assign the lesson subject a day or two in advance and have the class, a group of students, or the individual pupil, consult the textbook, the College and Government bulletins, agricultural reference books, farm papers, and every other available source for all possible information pertaining to the lesson. Allow them to tell orally what they know or have found out, asking just enough questions or making just enough comments to keep the discussions going. These class discussions may be varied by assigning the pupils different subjects for essays or reports, or by having debates on some timely topic once or twice a month.

Encourage the pupils to make Agricultural Booklets. Getting up such a booklet not only crystallizes the pupil's knowledge of what he has been studying, but it very effectively correlates the writing, drawing, spelling, composition, English and, in fact, every other school subject with agriculture in a most wholesome manner.

Have the pupils, as part of their writing lesson, write to the Division of Publications, U. S. Department of Agriculture, Washington, D. C., for copies of the Farmers' Bulletins listed in the bibliography. The Yearbooks of the Department of Agriculture can be obtained by writing your Congressman or Senator. The College publications are obtainable by writing to the Extension Service, Oregon Agricultural College, Corvallis.

By having the pupils write for these bulletins three or four weeks before they are needed, each child asking for not more than five at any one time, a splendid school library can be obtained free of cost and the pupils will be getting very good training in letter-writing at the same time.

How to Use the Bibliography.—The pages in the text that deal with the subject are indicated after each weekly topic. The other numbers given as references are keys to the

bulletins and publications that have to do with the subject under consideration. Thus, "key number" 25 refers to Farmers' Bulletin 113, "The Apple and How to Grow It."

Acknowledgments are due Professors G. R. Hyslop, H. W. Wilson and E. C. Beckwith, and Messrs. E. P. Walls, R. M. Rutledge and L. P. Gambee for assistance rendered in preparing the exercises. Free use has also been made of several of the very excellent lessons in agriculture outlined in the Cornell Rural School Leaflets.

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THE COURSE BY MONTHS

SEPTEMBER: THIRD WEEK

TOPIC: CROPS—Wheat; Oats; Corn or Potatoes. (Text, pp. 62-73; 284-297.) (Study the crop of greatest importance in locality.)

Other References: Wheat, 61; 70; 76; 84; 105; 117-B; 127; 129; 136; 155; 158-A; 164; 164-A. Corn, 68; 78; 100; 101; 124; 126; 165; 169; 170; 178; 227. Potatoes, 5; 22; 106-A; 110; 117; 122; 167; 225; 316; 317; 358.

Suggestions: Encourage the pupils to make a collection of grain in the sheaf, ear corn, or potato tubers, as well as to bring specimens of mature plants, roots intact, to class. Have a potato or corn show on Friday afternoon and invite the parents. Encourage the pupils to compete in a judging contest.

Lesson Topics: (a) The importance of seed selection. Methods used. (b) Acre yields, total yields and value of the crop on home farm; in county; State; United States; other countries. (c) Methods used in harvesting and marketing the crop. (d) Uses of the crop and its by-products.

Only those two exercises which pertain to the crop being studied should be required of the pupils.

EXERCISE No. 1:

Purpose: To learn how to select and judge seed corn.

Material: *Five or more ears of corn of the same variety. Score cards* (score cards for judging wheat, oats, corn and potatoes may be obtained from the Extension Service, Oregon Agricultural College). Copy the score card on the blackboard for the benefit of the class.

Procedure: In judging or selecting corn for exhibition purposes, the following score card is used. It should be understood, however, that the score card is simply a guide in the selection of corn for seed purposes.

	Perfect Score	Student's Score
Adaptability—Maturity, size, solidity, etc.	25	
Seed Condition—Large, bright germ, free from discoloration	15	
Shape of Kernel—Medium deep, slightly wedge-shaped, straight sides	15	
Uniformity—True to type, uniform size, shape, etc.	15	
Weight of Ear—Large proportion of grain	10	
Length and Circumference—Medium	10	
Color of Grain and Cob—Free from mixture	5	
Butts and Tips—Well filled	5	
	100	

Adaptability is the most important single item in the selection of corn. In other words, is it adapted to the conditions? Adaptability is indicated by its maturity, by its size, solidity, color and the appearance of the grain itself. In making tests for maturity, the ear is grasped in both hands and twisted. If it is solid, and gives a sort of creaking sound when twisted, good maturity is indicated. If the kernels may be pushed into the cob easily by the thumb, it is an indication of poor maturity. If the color of the ear shows a pale and immature appearance and the kernels, especially the germs of the kernels, present a swollen appearance, it is indicative of poor adaptability. Kernels that present a pinched appearance at the surface or that are chaffy usually indicate poor maturity. If the ears twist easily in the hand, immaturity is shown. Ears may be too small or too large. A good ear for Oregon conditions will be from eight to ten inches in length. Ears having a large cob cannot mature properly.

Seed Condition of the corn is indicated by a good, bright color of kernel and by a large, bright germ that is free from any discoloration. The germ should have a live look and be smooth and free from wrinkling or from breaking off of the tip cap, when it is removed from the cob. Also, there should be no mould between the kernels or next to the cob.

Shape of Kernel varies with the variety, but should be of good depth and should not be pointed at the tip. The width at the top of the kernel should be two to three times greater than the thickness.

Uniformity of the corn determines its trueness to type. All the ears of an exhibit should be uniform in size, in shape, in color, in shape of kernel and in all characteristics. It will be difficult to get ten ears that are exactly uniform, but care should be taken that they are as nearly alike as possible in length, circumference, shape, color and such characteristics.

Weight of the Ear is an important point. Experiments have indicated that all other things being equal, the heaviest ear is the best producer. However, weight must not be had at the expense of maturity. In Oregon, an ear weighing eight to ten ounces when well matured is of satisfactory weight. Ears having a small cob and deep grains are best.

Length and Circumference. Very long, slender ears should be avoided as they frequently break off in wind storms in the field. This type of ear dries out well, but the extremes of this type should be avoided. Short ears having a large diameter, and consequently a large cob, do not dry out well under the conditions prevailing here in Oregon and should be avoided. The medium types are to be preferred. The circumference of the ear at one-third of the distance from the butt to the tip should be between three-fourths and four-fifths of the length of the ear. A good length for Oregon corn is from eight to ten inches.

Color of the grain should be uniform throughout, as uniformity of color indicates freedom from mixing. The cob of yellow corn should be red; of white corn, white; of white-capped corn, it may be either red or white, although the red is preferred.

Butts and Tips should be well filled. The rows of corn should be carried out uniformly over the butt end of the ear and partially fill the end of the ear. The shank or place of attachment should be of medium size, not so small that the ear will blow off the stalk in the wind nor so large that it will be difficult to break off when husking takes place. At the tip of the ear, the kernels should be carried out in straight rows and the cob should be well filled. A small amount of bare tip of the cob is not undesirable.

In selecting the corn for the exhibit, get an ideal ear in mind and select all the ears available that approach this type. Later, a closer selection may be made, taking care that all the ears are well-matured or are adapted to the conditions; that the seed condition is good; that they have a good kernel and, especially, that they are uniform in all outward characteristics. In order to secure ten ears that are uniform, it may be necessary to sort over several bushels of corn.

EXERCISE No. 2:

Purpose: To make a careful study of the mature corn plant.

Material: Three stalks of mature corn with ears and roots intact.

Procedure: (a) Make a sketch of the corn plant and indicate on the drawing the following parts: true roots; brace roots; stalk; nodes; leaves; ear; silks; tassels. (b) Judge the corn plants, using the following score card for that purpose.

SCORE CARD FOR JUDGING THE CORN PLANT

	Perfect Score	Student's Score
Maturity of Plant for Grain or Forage—Corn for grain, past hard dough stage and partly dry; for forage, advanced hard dough stage before frost	25	
Size, Character and Position of Ear—For grain, one medium sized, well filled, solid ear, of good quality, placed about 3½ to 4½ feet up the stalk; for forage a larger ear, well filled, and reaching an advanced hard dough stage	25	
Weight of Plant—The heavier the plant, of good quality, the better	10	
Number and Character of Leaves—For forage, numerous (13 or more), broad, thick and long; for grain corn, 9 or more medium sized, thinner than for forage corn, as a rule, but varying to fairly large ones	10	
Height of Plant—7 to 11 feet (on dry farming land, 5 to 9 feet). Reduce score for shorter or longer	7	
Size of Stalks—Medium sized; neither spindling nor very coarse	7	
Vigor and Health of Plants—Strong, up-standing, bright colored, free from striped leaves or disease	10	
Freedom from Suckering—Suckers limit both grain and forage production	6	
	100	

Suggestions: The wind is the worst enemy of corn. Note how the structure of the plant is arranged to withstand the attacks of the wind; brace roots; cylindrical stalk, with shortest nodes at base; structure of the leaf (strong midribs with parallel veins).

EXERCISE No. 3:

Purpose: To become familiar with the market and seed requirements of wheat, oats, or barley.

Materials: A measured amount, by weight, of the cereal studied, for each student. (Two-ounce samples are recommended.) The grain, which should be of the variety grown to the greatest extent locally, is to be taken from the bin just as it came from the thrasher. Postal scales will prove very serviceable. Have the pupils make a copy of the score card for their own use.

Procedure: Place the sample of grain on a sheet of white paper. The score card may be written on the board, or copied by each student. With the score card as a guide, each pupil is to study the grain sample, point by point.

SCORE CARD FOR THRESHED GRAIN

	Perfect Score	Student's Score
Seed Condition, as indicated by dryness, freedom from smut or other disease, freedom from frost injury and freedom from swelled or sprouted grain. Good seed grain should be of large size and have a bright live appearance	20	
Color of Grain. The color of grain varies with the variety but whatever the color is, it should correspond with the natural color of the variety. It should have a fresh, bright appearance and be free from bleaching or staining due to exposure. When varieties are compared, the red and amber wheats are usually preferred to the white. The white oats and barley are usually preferred to the gray, black or other colored varieties of these cereals	5	
Uniformity. Uniformity of color, shape, size and appearance indicate good type and freedom from mixing. All grain should be uniform in physical characteristics whether it is to be used for seed or for milling purposes. Pronounced variations in size, shape, color or appearance of grain seriously injures its market quality	25	
Soundness and Purity. Soundness refers largely to the quality of work that has been done in threshing. Cracked grain, or in the case of oats, hulled grain is distinctly objectionable. The fault lies not so much with the grain as with the manner of threshing. All grain should be free from weeds, chaff, etc. For every per cent of broken grain, weeds, chaff, smut, dirt, etc., that can be separated out, cut two points	25	
Weight per Bushel. The heavier the weight per bushel the better the manufacturing quality of the grain and also the better the value for seed purposes. Wheat should weigh 60 pounds per bushel, oats 32 pounds per bushel, barley 48 pounds per bushel and rye 56 pounds per bushel. Cut two points for every pound below standard	25	
	100	

A great deal can be done to improve the uniformity, soundness and purity and the weight per bushel by putting the grain through a good fanning mill and grain grader.

Explanation: In selecting grain for seed or market there are certain conditions which must be fulfilled. First, there is a best variety of grain for every location and for every purpose. Second, the market or seed quality of the various samples of the variety must be known. The first is determined by cultural experiments. The second, by judging the grain itself.

EXERCISE No. 4:

Purpose: To become familiar with the wheat, oat or barley plant.

Materials: A number of plants pulled up and preserved so that the roots as well as the stems, heads and grain are intact.

Procedure: The following score card is to be used as a guide in studying a cereal plant. Write the score card on the blackboard and require the pupils to copy it.

With a plant on each pupil's desk, have them follow the score card point by point in studying their specimen.

SCORE CARD FOR JUDGING CEREAL PLANTS

	Perfect Score	Students Score
STOOLING HABIT:		
Number of Stalks per plant—Make no cut for plants having 6 or more stalks	10	
Uniformity of stalks produced—All stalks of a plant should be uniform. Small stalks developing late only reduce the yield	5	
STRAW:		
Height—It should be high enough to be cut without loss or inconvenience	5	
Stiffness—It must be stiff enough to support the head and to avoid lodging	5	
Leafiness—A large leaf surface improves the forage value and shows vigor	3	
Disease Resistance—Plants should be free from rust and other diseases	5	
HEAD:		
Position—A rather erect head is preferable. Heads may be erect, leaning, nodding	2	
Beardless or Bearded—Beardless is preferable; a few short beards are not seriously objectionable	2	
Shape—A medium compact head carrying its size out to the tip is desirable	5	
Number of spikelets or meshes—The divisions on each side of the head of wheat or barley or at the ends of the branches of oats are called spikelets or meshes. There should be as many as possible	10	
Number of grains per spikelet—A large number is desirable, three or more for wheat, two or more for oats. There is one for barley and two for rye	10	
Freedom from Shattering—The heads should hold the grain well but should not thresh excessively hard	6	
GRAIN:		
Natural Color—Red or amber wheat is preferred to white wheat, white oats or barley are preferred to the colored varieties	2	
Plumpness—Grain should be plump and free from shriveling	10	
Weight per Bushel—Grain should be heavy. Minimum weights should be: Wheat, 60 pounds; oats 32 pounds; barley, 48 pounds; rye, 56 pounds	10	
Quality—Grain should be free from smut, frost injury, bleaching due to exposure, staining from being wet, mold, sprouting, etc.	10	
	100	

Explanation. The cereals are the most valuable field crops produced in Oregon, although our average yield per acre is low. The yields can be increased by the proper selection of seed, and seed selection depends upon an intimate knowledge of the individual plant. Students coming from homes where grain is the money crop should be encouraged to give special attention to this subject.

EXERCISE No. 5:

Purpose: To learn how to select and judge seed potatoes.

Materials: Ten or more potato tubers of the same variety. Copy score card on blackboard for the benefit of the pupils.

Procedure: In selecting potatoes for exhibition, we must bear in mind that the tubers are grown for market purposes and that the best potato for exhibition is also the best potato for market. This score card is a guide for the selection of potatoes for market purposes.

SCORE CARD FOR JUDGING POTATOES

	Perfect Score	Student's Score
Trueness to Type—Variety characteristics	10	
Uniformity of Exhibit—In size, shape, color, surface, etc.	10	
Shape of Tuber—Symmetrical and free from depressions or protuberances	10	
Size—Medium sized, 5 to 8 ounces (cut 6 points if too large, 9 points if too small)	15	
Skin—Firm, smooth, and free from sunburn, discoloration, scab, and other blemishes	20	
Flesh—Solid, small centers, free from worm holes, rot, etc. Even in texture, of a clear color and free from sogginess or discoloration, of any kind	25	
Eyes—Few in number, strong, but not broad or deep, according to variety	10	
	100	

Trueness to Type. This item simply covers variety characteristics. The potato must be true to the type of the variety whose name it bears.

Uniformity of Exhibit. No potato is valuable for market purposes or for seed purposes unless it carries considerable uniformity. If there is lack of uniformity, it shows that the type of potato is not a very constant one; that there is evidence of mixing. The potatoes must be uniform in size, shape, color, appearance of the surface, texture, etc. In selecting potatoes for exhibit, this is one of the most important points.

Shape of the Tuber. The shape of the tuber is in part determined by the variety of the potato, but aside from this, the tuber must be symmetrical and of pleasing shape and of a shape that will peel satisfactorily. There must be no depressions or protuberances and the potato itself must be symmetrical, not crooked or deeply pitted. Such potatoes that have deep depressions, pits, protuberances, or that are badly crooked do not look well and do not peel economically.

Size. The market demands a medium sized potato that weighs in the neighborhood of five to eight ounces. In most of Western Oregon a five to seven-ounce potato is satisfactory. Large potatoes are less objectionable than small ones, but the ideal sized potato is one that suits the hotel trade, which is one that when baked will make a satisfactory meal for one man.

Skin. The skin is the portion of the potato that is observed by the buyer, and its color also serves to protect the food that is stored beneath. It should be firm and not readily broken, but, on the other hand, it should not be wilted and leathery. The skin should be smooth and free from any sunburn, discoloration, scab or other blemish because such things indicate poor quality and a high percentage of peeling.

Flesh of the potato should be solid, of even texture and of a good clear color. There should be no indication of sogginess or a discoloration of any kind. The texture of the flesh should be uniform throughout without any worm holes or mechanical injury.

Eyes. The number and character of the eyes depend a good deal on the variety. But the ideal from the standpoint of the market is a type which has relatively few eyes and these not very broad or deep. A potato which has numerous, deep eyes will not peel satisfactorily so that with any variety the ideal is approached when we choose a type that has the medium number of eyes and those not broad or deep.

In selecting potatoes for exhibit purposes, under no condition select the larger sizes and whatever size is decided upon as best should be used throughout the entire exhibit. Do not put in any large ones in an exhibit of medium-sized potatoes because such potatoes are likely to injure the entire exhibit. Avoid bruised, cut, or diseased potatoes and all tubers that are misshapen in any way.

EXERCISE No. 6:

Purpose: To make a careful study of the potato plant.

Material: Have the pupils bring at least five hills of potatoes to school. The tops and roots should be intact and by careful digging many of the tubers will remain attached as well. Copy the score card on the blackboard.

Procedure: 1. Make a sketch of the entire potato plant, showing the roots, tubers, stems, leaves, flowers and fruit (the potato balls, if any can be found). 2. Judge the hills of potatoes, using the following score card as a guide:

SCORE CARD FOR JUDGING POTATO HILLS

	Perfect Score	Student Score
Weight of Hill—Heavy hill with large number of uniform medium sized potatoes	20	
Uniformity of Tubers—Uniform in size, shape, color, etc.	10	
Size of Tubers—Medium sized, 5 to 8 ounces	15	
Shape of Tubers—Symmetrical, free from depressions or protuberances	15	
Skin—Firm, smooth, and free from sunburn, discoloration, scab and other blemishes	15	
Flesh—Solid, free from worm holes, sogginess, discoloration or mechanical injury	20	
Eyes—Few in number, strong but not broad or deep, according to variety	5	
	100	

SEPTEMBER: FOURTH WEEK

TOPIC: HORTICULTURE—Apples; Pears; Prunes; Etc.

References: Pome Fruits, 25; 95; 97; 146; 189; 230; 307; 324; 364. Stone Fruits, 42; 60; 97; 130; 189; 369; 370.

Suggestions: Encourage the pupils to bring to school specimens of as many varieties of apples as can be obtained in the community. Hold an apple show on Friday afternoon. Invite the parents and have a special program. An apple-judging contest might be held among the pupils.

Lesson Topics: (a) Methods used in harvesting and preparing the crop for market. (b) Methods used in marketing the crop. By-products and their disposal. (c) Fruit districts of the county; of the State. Varieties grown. Importance of the crop. Yield. Profits.

EXERCISE No. 7:

Purpose: To understand the structure of pome and stone fruits.

Material: An apple or pear and a prune or peach for each student.

Procedure: (a) Have one pupil cut an apple or pear lengthwise of the fruit, perpendicular to the main axis. (b) Have another pupil cut a fruit in two at right angles to the main axis. By exchanging halves, each pupil will have two different sections of the fruit to study. (c) Make a drawing of the cross and longitudinal sections of the apple and show the following: skin; flesh; carpels; cells of the core; the seeds; the cavity; basin; the calyx lobes; calyx tube; tell how the seeds are attached; describe the color of the flesh and flavor. (d) Cut a prune or peach in two lengthwise. Make a sketch and indicate the following parts: stem; cavity; apex; suture; stone, seed; embryo; observe the dots and bloom on the skin. (e) Compare the structure of the prune or peach pits with the seeds of the apple or pear. In what way do they resemble? How do they differ? Examine both types of seeds carefully and note the size, position and shape of the embryo.

EXERCISE No. 8:

Purpose: To give pupils an idea of the relative merits of the different varieties of fruit.

Materials: Students should bring to school five specimens of the best fruits that can be obtained. Place on paper plates, being careful not to mix the varieties on a plate.

Procedure: Place each variety exhibit together. Have the students pick out what they consider to be the best plate of each variety. Use the following score card as a guide:

SCORE CARD FOR JUDGING FRUITS

	Perfect Score	Student's Score
Color	20	
Uniformity of size, color, etc.	20	
Size	20	
Shape	20	
Freedom from insect or disease blemishes	20	
Total	100	

Suggestions: If enough varieties can be obtained to make an attractive exhibit, hold a fruit show on Friday afternoon and invite the public. Encourage competitive judging among the pupils.

OCTOBER: First Week

Topic: Insect Pests—Orchard, field, garden crops. (Text, pp. 118-140.)

Other References: 20: 22; 23; 28; 31; 73; 76; 147; 155; 167; 186; 204; 210; 226; 242; 321; 323; 328; 332; 341; 344; 347; 351.

Suggestions: Encourage students to make a collection of insects common to the locality, outside of school hours. Full directions for doing this work will be found in references 186 and 250. A collection of fruit, leaves and branches, showing the results of insect work, should be made a part of the permanent exhibit of the school.

Lesson Topics: (a) Annual loss caused by the various insect pests in the State; in the United States. The important insect pests of the locality; of the State; their habits. (b) The life histories of some noxious insects. The importance of knowing the life history of an insect. (c) Methods of prevention and control; cultural methods; natural enemies; sprays; etc.

Exercise No. 9:

Purpose: To be able to recognize some of the more common insects and to become familiar with their habits.

Materials: Students should be encouraged to collect as many insects as possible. Directions for killing and mounting insects will be found in references Nos. 186 and 250. Any insect which cannot be identified locally should be sent to the Department of Entomology, Oregon Agricultural College.

Procedure: (a) Divide the insects collected into three groups, according to whether they are *noxious*, *beneficial* or *neutral*. (b) Make a list of the insects collected and indicate whether they are *biting* or *sucking* insects. (c) Make another list of the insects collected and note whether they have a *complete* or *incomplete metamorphosis*.

Explanation: (a) *Noxious* insects are those which are detrimental to the welfare of man. *Beneficial* insects are those which produce some economic product, or which destroy other insects. *Neutral* insects are those which are apparently neither noxious nor beneficial. (b) All insects develop in such a way that their mouth parts are adapted for biting or sucking. Biting insects live by feeding on animal or plant tissues. Sucking insects live on the juices of animals or plants. (c) Metamorphosis means change in form. Nearly all insects have what is called a complete or incomplete metamorphosis. Those which pass through the four stages of egg, larva, pupa and adult are said to have a *complete metamorphosis*. The others have the egg, nymph and adult stages, but do not pass through the pupal or resting stage.

EXERCISE No. 10:

Purpose: To give pupils some knowledge of the structure of an insect.

Material: Grasshoppers, to be collected by the pupils. If none are obtainable in the locality, write to the Department of Entomology, Oregon Agricultural College.

Procedure: Make a sketch of the grasshopper and indicate the various parts mentioned on page 119 of the text.

Explanation: An insect's body is divided into three distinct parts: the head, thorax, and abdomen. An adult insect has one pair of *antennae* (feeders), three pairs of legs and usually one or two pairs of wings. The insect *skeleton* is on the *outside* of the body and serves as a sort of protective armor. The hard chitinous skeleton is usually composed of 13 rings or segments, fastened together by a soft, flexible tegument. The head bears the antennæ, eyes and mouth parts. The thorax is divided into three parts, called the prothorax, mesothorax and metathorax. Each division bears one pair of legs and the last two named bear the wings, when wings are present. The abdomen bears no appendages for locomotion.

OCTOBER: SECOND WEEK

TOPIC: PLANT DISEASES OF ORCHARD AND GARDEN. (Text, pp. 94-117.)

Other References: 22; 73; 76; 147; 164-B; 167; 226; 242; 300; 303; 331; 342; 343; 349.

Suggestions: Collect as many different kinds of plant diseases as may be obtainable in the neighborhood. Make a permanent exhibit of diseased specimens, properly mounted and named. The County Agriculturist, Fruit Inspector, or the Department of Plant Pathology, Oregon Agricultural College, will gladly identify all diseased specimens.

Lesson Topics: (a) Losses caused by plant diseases in the State; in the United States. Important plant diseases of the section; of the State. (b) The nature of a fungus—how it lives and multiplies. Difference between parasites and saprophytes. (c) The life history of a fungus governs the methods of control. Remedies: Cultural methods, sprays, etc.

EXERCISE No. 11:

Purpose: To acquaint the pupils with the vegetative and reproductive portions of common fungus.

Materials: A glass tumbler and saucer; small sheet of blotting paper which will fit easily under the inverted tumbler. Small slice of fresh bread; also some old stale bread. Two plates.

Procedure: (a) Moisten a small piece of old bread with lukewarm water and place on a piece of moistened blotting paper in one of the plates. (b) Expose moistened bread to air for a short time; cover with a second plate and set in a warm place. (c) Examine bread at end of two days. On it you should find a dense fungus growth. If the fungi have not yet developed, the plate should be allowed to stand a day or two longer. The fungi may be green, brown or black. The black growth are cultures of *Rhizopus nigricans* (Bread mold) and are the type to be studied. (d) Sterilize the tumblers, saucers, and small pieces of blotting paper with boiling water and pour hot water over the slice of fresh bread. Keep this bread away from the air as much as possible by placing it on the blotting paper in the saucers and inverting the tumblers over it. Any excess moisture which may collect in the bottom of the saucers should be poured out. (e) Inoculate the scalded pieces of fresh bread with the black bread mold fungus by dipping the point of a needle into boiling water and then using it to transfer a small speck of the black fungus from the old bread culture to the sterile slice of fresh bread under the tumbler. Raise tumbler just high enough to touch bread with the needle. Place in warm place and examine from day to day. Have pupils watch closely for first indication of the growth on the inoculated bread and as soon as it is evident a study of it should be commenced. (f) Notice the growth of very slender threads which form the vegetative portion of the fungus. These correspond to the roots, stem, and leaves of higher plants. One thread is called *hypha* (pl. *hyphae*), the entire mass of hyphae being known as the *mycelium*. Notice the color, size, distribution, branching, etc., of the mycelial filaments or threads. Observe how the plant spreads by sending out runners, or stolons, very much like strawberries, which creep over the bread, fasten themselves at intervals, and send up clusters of short branches. Remove the bread from under the tumbler and examine to see if the *mycelium* grows on the surface or down into the interior. Study the fruiting portion of the fungus (the little round balls in the ends of short threads). Note that the fungus which was white or green at first has now turned black. The little balls have given the fungus the black color, each little ball containing thousands of tiny black spores, very much like peas are contained in a pod. The fungus "pod" is really the thin covering of the ball which is called *sporangium* (meaning a spore bearer or a spore case). Touch the blackened area as lightly as possible with the finger tip and note the black dust which clings to it. This dust is really masses of the little spores which have been freed from the spore case. Under natural conditions these spores are scattered about by the wind or by moisture and when they come in contact with suitable material for growth they immediately sprout or germinate and give rise to new plants.

Exercise No. 12:

Purpose: To demonstrate the relation of bruising and rough handling to the keeping quality of apples.

Materials: Three or more sound apples; a pin.

Procedure: (a) Bruise one apple by dropping on the floor. (b) Inoculate a sound apple by puncturing the skin with a pin that has touched the decayed part of another apple. (c) Place both apples along with a perfectly sound one where they will not be disturbed. Note the relative length of time each apple keeps. Also note the part of the apple that begins to decay first.

OCTOBER: Third Week

Topic: Weeds—(Text, pp. 73-76.)

Other References: 102; 115; 116-E; 163-A; 168; 305.

Suggestions: Make a collection of the most common weeds in the locality. Those which are the greatest pests should be properly mounted and preserved, roots intact. If the scientific names are desired, send specimens to the Department of Botany, Oregon Agricultural College.

Lesson Topics: (a) Effect of weeds upon crops. How they injure cultivated plants. Why we cultivate. (b) How weeds spread. Dissemination by roots, seeds, wind, animals, railroads, etc. (c) Methods of control: rotation of crops, summer fallowing, spraying, etc.

Exercise No. 13:

Purpose: To acquaint the pupil with some of the striking characteristics of our common weeds.

Material: The list of weeds to be studied will vary slightly in different parts of the State. Collect a plant of each of the most important weeds, roots intact and in flower or fruit. Separate lists are given for the eastern, western, and southern portions, as follows: Eastern Oregon—Russian Thistle; Silver Salt Bush; Jim Hill Mustard; Lamb's Quarter; French Weed. Southern Oregon—Chickweed; Plantain; Wild Carrot; Bull Thistle; Dandelion. Western Oregon—Sheep Sorrel; Prickly Lettuce; Bachelor's Button; Dog Fennel; Shepherd's Purse.

Procedure: Place the weeds on a table, and go over each one carefully, noting the following points: The character of the roots (whether they have a main central root with branches, or a number of branches arising from just below the stem); character of the stems (solitary or numerous; branched or unbranched; fleshy; woody or hairy; erect or climbing); shape and character of the leaves (all in one piece or composed of separate portions or leaflets; how the veins run in the leaves); character of the flowers (how they are arranged). If the weeds bear their flowers in heads, how many flowers are there on each head; are all the flowers of the head alike? Note the character of the fruit which results from the flowers; also the seed which will be found within the fruit. Keep these plants for the next exercise.

Suggestions: Find out the answers to the following questions: Which of these weeds is it unlawful to allow to mature seed in Oregon? Which are the most common among those studied? In what sorts of places are each one of these weeds found growing? What is the length of life of each of the weeds studied (one year; two years; more than two)? In the case of those weeds which live two years, are any seeds borne the first year? In the case of those which live more than two years, are seeds borne each year? What other means of propagation do some weeds have in addition to seeds?

EXERCISE No. 14:

Purpose: To determine the number, character and vitality of some common weed seeds.

Material: Some seed saved from plants studied in previous exercise. Also the whole fruit of these weeds as well as the seed.

Procedure: Note the kind of fruits, especially as to whether there are any means by which they can easily be carried by wind, water, animals, or in other ways. Determine the number of seeds borne in each fruit. Estimate the number of seeds borne on each plant. Count out one hundred seeds of each of the weeds studied and germinate them on moist blotting paper between plates. What is the percentage of germination? Do the seeds of all these weeds germinate equally well? If they do not, save some of the seed until next spring and then make another germination test. If they do not grow in the fall, but do grow in the spring, what would that indicate?

Suggestions: Noting the average number of a given type of weeds growing on a certain area of ground, and estimating the average number of seeds produced by each plant, how long would it take one plant to cover an acre of ground to a like extent? Do all weed seeds grow equally well as soon as mature? Do some weed seeds require a resting period before they will grow? How are some weeds spread from one place to another? What provision is made for carrying the weed's fruit by the wind? How would you distinguish between the fruit and seed of a weed?

OCTOBER: FOURTH WEEK

TOPIC: POULTRY HUSBANDRY—Eggs and Egg Production. (Text, pp. 204-206.)

Other References: 29; 93; 137-A; 173; 183; 200; 202; 221; 235; 371; 387, 392.

Suggestions: Encourage the pupils to make a collection of eggs representing as many different breeds of poultry as possible. Hold an egg show in school on Friday afternoon and arrange to have some poultryman or merchant demonstrate candling and the proper sorting and packing of eggs.

Lesson Topics: (a) Egg yields; trap-nesting; high laying strains. (b) Making and using the trap-nest. (c) Marketing eggs; best methods. (d) Use of eggs for food.

EXERCISE No. 15:

Purpose: To teach the structure and function of an egg.

Materials: Each group of four pupils should be supplied with two eggs, one with light shell, the other with dark shell if possible; two saucers. There should be a good lens for the general use of the class; an alcohol lamp and kettle, or other facilities for boiling eggs; an egg-tester. The egg-tester can be made by placing a candle or a lamp with chimney in a box, with a hole slightly smaller than the egg cut through the side. By placing an egg over the opening in a darkened room, the interior of the egg can be plainly seen.

Procedure: *Strength of the Egg Shell.*—Let each student hold a hard-shelled egg between the clasped hands, the ends of the egg in the hollow of the hand, and try to break it. Observe the great strength of the egg, due to the arch-like arrangement of the particles of the shell, similar to the stones or bricks in the arch of a bridge. This arrangement gives the egg great resistance against injury to the shell, or to the chick which is developing within the egg.

The Contents of an Uncooked Egg—(a) Break a fresh, uncooked egg in a saucer by separating the shell in the middle.

Observe the "germinal disc," which appears as a light-colored spot usually to be found on the upper surface of the yolk. The germinal disc contains the life principle of the egg. On the upper surface it remains in close contact with the source of heat during natural incubation, which is from above.

(b) Note the "chalaza," or the whitish cords of denser albumen on the sides of the yolk toward either end of the egg. These cords of denser albumen serve to keep the yolk properly suspended within the albumen. Thus the chick which develops on the upper surface of the yolk is protected from injury, if, through rough handling, it should come in contact with the shell.

(c) Note the transparent watery appearance of the albumen (white of the egg). The albumen supplies the food in liquid form by which the chick grows within the shell.

(d) Examine the shell and note the air-space usually found near the large end. Observe the brittleness of the shell and the two tough membranes best observed at the air-space, where the membranes separate. The air-space furnishes a readily available supply of fresh air to the embryo chick. The two membranes prevent the too rapid evaporation of moisture through the pores of the shell, but allow oxygen to enter the egg and carbon dioxid to pass out.

(e) By placing a section of the shell under the lens, indentations or pores in the shell may be observed. These thinner parts permit the gases to pass more readily through the shell. If the pores of the shell are covered by oil, varnish, dirt, or broken egg, the pores will be closed and the chick smothered.

(f) Note the pigment of the shell, which gives to each egg its characteristic color. Observe in nature how the first eggs laid for a brood are more pronounced in color, and how the color pigment decreases with each egg that is laid, due to exhaustion of the supply.

The Content of a Boiled Egg—Crack carefully, on the large end, the shell of a hard-boiled egg; remove the shell carefully piece by piece to avoid tearing the shell membrane.

(a) Observe the air-space and the two membranes, which are separated with difficulty. Note that the outer membrane is the thicker and tougher.

(b) Cut the egg lengthwise through the middle. Observe the lighter-colored flask-shaped center of the yolk and the darker yolk arranged around it in concentric layers. Note the "germinal vesicle" or "germinal disc" at the upper part of the light yolk. Observe that the yolk is at one side and not in the center of the white of the egg. Note also that the germinal disc is on the upper side of

the yolk. This is because the yolk is lighter in weight than the albumen and hence floats. The germinal disc on the surface of the white yolk is lighter than the dark yolk.

The chemical composition of the dry substance of the inside of the egg is:

	Protein	Fat
White (albumen, white of the egg)	88.92	.53
Yolk	20.62	64.43

There is a large amount of fat in the yolk and almost no fat in the albumen. Fat is lighter than albumen, hence rises to the surface. This may be observed in practice by holding a fresh egg in front of an egg-tester and noting the tendency of the yolk to float.

This tendency of the yolk to float to the surface makes it necessary frequently to turn eggs which are kept for hatching; otherwise the yolk will rise until the germinal disc comes in contact with the shell membrane, which becomes dry by evaporation and allows the *vitelline* membrane to adhere and thus become ruptured, killing the germ when the egg is moved.

(c) Make a drawing, longitudinal section (the outline to be 1½ times natural size) showing directly from the egg itself the following:

(a) The shell and its pores. (b) The two shell membranes turned back from the shell. (c) The air space. (d) The three layers of albumen. (e) The vitelline membrane surrounding the yolk. (f) The vitellus yolk, showing its concentric layers. (g) The germinal disc. (h) The chalaza ("hammock cords").

DEFINITIONS

Vitelline Membrane—A delicate film-like skin, which encloses the liquid portion of the yolk of the egg.

Vitellus—The yellowish-like substance within the yolk of an egg—closed by the vitelline membrane.

Embryo—The young chick in the first stages of development, before it leaves the shell.

Concentric layers—Thin layers of yolk substance of different shades appearing to be arranged in rings, one within the other, whichever way the yolk of a hard-boiled egg is divided.

Incubation—The process of development of a chick within the egg, requiring heat, moisture and air.

Chalaza—A twisted band of thickened albuminous substance (white of egg) to be found attached to the yolk for the purpose of keeping it properly suspended.

Shell membrane—Two thin skin-like tissues which line the inside surface of the shell of the egg.

Germinal vesicle, germinal spot, germinal disc—The part of the yolk of an egg undergoing incubation, which contains the first traces of the developing chick.

(This exercise is adapted from the Cornell Rural School Leaflet.)

NOVEMBER: First Week

Topic: Poultry Husbandry—Types and Breeds; Housing; Care. (Text, pp. 204-206.)

Other References: 16; 45; 47; 57; 93; 139-A; 162; 163; 173; 187; 176; 200; 221; 229; 232; 234; 373.

Suggestions: Encourage the pupils to hold a poultry show at school. Each pupil should bring one to three birds in a suitable coop. Arrange to have some poultryman in the neighborhood to judge the exhibits. Give blue, red and white ribbons as prizes.

Lesson Topics: (a) Types and breeds of farm poultry. Origin of the different varieties. (b) Housing and yarding of the laying stock. (c) Feeding for eggs. (d) Poultry pests and diseases. (e) Turkeys, ducks and geese.

EXERCISE No. 16:

Purpose: To teach the pupils the parts of a fowl and the purpose of each.

Material: Two fowls of any breed, both male and female. These may be obtained from the pupils and brought to school in suitable coops. An outline drawing of the fowl should be placed on the blackboard and the various parts of the fowl indicated.

Procedure: Have one of the older pupils place the fowl on a table on which a burlap sack has been spread, so all the class can see. Then the teacher or one of the pupils should describe and name each part of the fowl and state its use. The pupils should then be required to make an outline sketch and insert the names of the different parts, using the following definitions as a guide:

1. Head—Includes face, eye, beak, comb and other parts.
2. Beak—The upper and lower horn-like parts of the mouth. For biting and tearing.
3. Face—The part of the head below and between the eye and the beak.
4. Comb—The fleshy growths attached to the top of the head. For ornamentation.
5. Wattles—The fleshy growths attached to the throat and the lower part of the beak. For ornamentation.
6. Ear Lobes—The fleshy enlargements on the face below the ear. For ornamentation.
7. Eye—The organ of sight. Note the method of opening and closing the eyelid.
8. Ear—The organ of sound. Observe the simple opening without external ear parts.
9. Nose—The opening of the air passages at the base of the beak.
10. Neck—The portion of the fowl which unites the head with the body and allows the head to be turned freely in various directions.
11. Back—The portion of the body between the neck and the rump.
12. Tail—The rump and feathers which are found upon it. For steering the body during flight.
13. Body—The under part and sides of the fowl between the breast and including the fluff.
14. Fluff—Soft feathers covering the abdomen.
15. Abdomen—The portion of the body between the rump and the keel covered with fluff feathers.
16. Keel—The lowest portion of the body between the abdomen and the breastbone. Heavy low-hanging portion of body giving balance and steadiness in flight.
17. Breast—The part of the fowl extending from the lower part of the neck to the keel. It is formed by the large muscles (white meat, pectorals) which move the wings during flight. Feel for the wish-bone.
18. Wing—The organ of flight. Stretch it out like a fan and note its large size and overlapping feathers.
19. Leg—The organ of locomotion, including the foot, shank, hock, thigh, and "second joint."
20. Thigh—The "first joint" of the leg above the hock.
21. Shank—The part of the leg between the foot and the hock. Note the large scales on the front side to protect the shank from injury.
22. Feet—The lower portions of the leg, including the toes. Used for scratching and perching. Move shank up and down at hock joint and observe the toes move.
23. Toes—The appendages of the feet.
24. Hock—The joint between the thigh and shanks.
25. Spur—The horny growth on the shank. Used for defense in fighting.
26. Cushion—The feather section of the female overlapping the base of the tail.
27. Cape—The feather section of the female at the junction of the neck and back.
28. Saddle—The feather section overlapping the base of the tail of the male.
29. Hackle—The feather section on the lower part of the neck overlapping the cape.

(This exercise is taken from the Cornell Rural School Leaflet, Vol. II, No. 2.)

NOVEMBER: Second Week

Topic: Dairying—Milk Testing; Milk Records. (Text, pp. 220-224.)

References: 30; 200; 215; 219.

Suggestions: If the school does not own a Babcock tester, a small outfit should be borrowed from some dairyman in the community. After the first one or two exercises are given in class, the pupils should be permitted to acquire proficiency by making tests after school, or during school time as a reward for getting their other lessons. As soon as a pupil becomes proficient, encourage him to test the home herd or some neighbor's cows, taking samples twice a month for a period of six to eight months.

Lesson Topics: (a) Principles of milk testing. (b) The composition of milk. (c) Keeping dairy records. Importance.

Exercise No. 17:

Purpose: To learn how to test whole milk. (Follow directions given in reference No. 219.)

Exercise No. 18:

Purpose: To learn how to test cream. (Follow directions given in reference No. 219.)

Exercise No. 19:

Purpose: Demonstration; to demonstrate some of the constituents of milk—fat, casein, sugar and ash.

Materials: Thermometer, bottle, saucer or pan, a little acid or vinegar, one quart of fresh milk.

Procedure: The Fat.—Allow a quart of fresh milk to stand in the pan in a cool place until the cream gathers. This may be removed by skimming. Place the cream in a bottle, filling it not more than two-thirds full. Warm to a temperature of about 60 degrees F., and then shake the cream. The fat globules will unite and form fat granules large enough to be seen. Most of the fat has been removed from the milk by this process. The Casein.—Add a few drops of weak acid or vinegar to the skimmed milk and as soon as it coagulates or thickens, warm to a temperature of 100 degrees F. Break the thickened portion into a few pieces with a knife or spoon. The skimmed milk has thus been resolved into two parts, the curd and the whey. The curds represent the casein or nitrogenous part of the milk. The Albumen.—Heat the whey to 160 degrees F., and observe that a clean, watery fluid will collect on the surface, which may be separated from the rest by skimming. This is the albumen, which is similar to the white of an egg. The Sugar.—A small quantity of whey which has been freed from its albumen should be placed on a clean shallow dish and carefully warmed, care being taken not to burn it. This may be done by placing in an oven with the door partly open. When the water has evaporated, a dry substance remains. The dry substance is seven-eighths milk sugar and one-eighth ash. The Ash.—Place part of the sugar and ash upon a metal spoon and hold over a flame. Allow it to burn as long as it will. The substance that remains is the milk-ash. Ordinary milk contains:

	Percent	In 1 Quart
Water	87	29.93 ounces
Fat	4	1.38 ounces
Casein	2.6	.89 ounces
Albumen	.7	.24 ounces
Sugar	5.	1.72 ounces
Ash	.7	.24 ounces
	100%	34.40 ounces

(Adapted from Cornell Rural School Leaflet, Vol. I, No. 2.)

NOVEMBER: THIRD WEEK

TOPIC: DAIRYING—The Dairy Cow. (Text, pp. 216-219.)

Other References: 11; 24; 91; 114; 191; 200; 202: 212; 213; 214; 222; 231.

Suggestions: Arrange to have a cow brought to school so the pupils can get practical experience in judging. Call upon your County Agriculturist or some dairyman in the neighborhood to point out to the class the characteristic points of a dairy cow. Encourage the pupils to do practice judging at home.

Lesson Topics: (a) How to use the score card. The conformation of the dairy type. (b) The types and breeds of dairy cows. Their origin and improvement. (c) The records of some high producing cows of different breeds. "The Register of Merit." (d) Feeding and care of dairy cows.

EXERCISE NO. 20:

Purpose: To become familiar with the conformation or judging points of a dairy cow. (See reference 231.)

Procedure: Become acquainted with all of the parts mentioned in the score card by an actual study of the animal itself.

SCORE CARD FOR DAIRY COWS

	Perfect Score	Student's Score
Mature cows should weigh 900—1200		
Animal No.		
Estimated weight		
1. Head—Rather long; forehead, wide; face, fine, clean cut; muzzle, large; eyes, full and lively; horns, small and oval at base	10	
2. Neck—Moderately long, thin, straight on top, free from loose skin on under side, clean at juncture with the head, not heavy at shoulders	3	
3. Shoulders—Sloping, not fleshy; withers, fine and pointed at top	2	
4. Chest—Sufficiently broad and deep to insure good constitution; brisket and whole forequarters light; body wider and deeper backward	10	
5. Back—Straight to setting on of tail; spine, well defined, especially at shoulders	3	
6. Barrel—Long, deep and wide at flank; ribs, long and wide apart	10	
7. Hips—Wide apart; square with hook bones	2	
8. Rump—Long, lean, level. Pin bones high and wide	2	
9. Tail—Set on level with back, reaching to hocks, tapering and pliable toward tip, switch full of long fine hair	1	
10. Skin—Loose, oily, moderately thin; hair, fine; secretion inside of ears yellow and abundant	8	
11. Fore Udder—Full and not fleshy, extending well forward on the level of the attachment of teats and joining belly by a very slight upward curve	13	
12. Hind Udder—Full in form and well up behind	11	
13. Teats—Rather large, wide apart, squarely placed	5	
14. Milk Veins—Prominent, extending forward and entering belly through large or numerous openings	5	
15. Disposition—Wide awake and alert, but kind and not irritable	5	
16. General Appearance—Three dairy wedges well defined. Throughout free from superflous flesh and fat. Legs short, straight, wide set, and clean cut. Thighs, open and incurved, giving room for udder	10	
Total	100	

TOPIC: CARE OF MILK AND ITS PRODUCTS:—(Text, pp. 224-227.)

Other References: 18; 30; 42; 110-A; 114-C; 116-C; 125; 145-E; 146-C; 166-A; 200; 216; 304; 309; 334; 391; 397.

Suggestions: The subject of sanitation in milk production is so important that it should receive the greatest possible amount of attention from pupils. The exercises suggested are simple and may be performed in any school.

Lesson Topics: (a) Dairy barn sanitation; scoring the dairy barn. (b) The disposal of barnyard manure; the water supply, etc.

Exercise No. 21:

Purpose: To make a test for cleanliness in milk production.

Materials: Two 4-ounce bottles. Some fresh milk.

Procedure: Cleanse and scald the bottles thoroughly. Fill up to the neck with fresh milk. Place a small piece of barn yard manure in one bottle. Tightly cork both bottles and set in a warm place. Open at the end of 24 hours. The milk in the bottle in which the manure was placed will probably have a putrid odor and fermentation will be occurring. The milk in the other bottle may be sour but it will be due to the normal souring of the milk.

Explanation: Whenever fresh milk ferments in a short time and has a putrid odor it is safe to say that it contains some barn yard contamination.

NOVEMBER: Fourth Week

Exercise No. 22:

Purpose: To demonstrate the effect of dirt upon the keeping qualities of milk.

Material: Seven 2 or 4-ounce vials or bottles; some cotton batten; fresh milk.

Procedure: Boil the bottles for half an hour. Remove and drain. Fill ¾ full of fresh milk and plug or cork with cotton batting. Sterilize by standing in boiling water for 40 minutes on three consecutive days. Label the bottles A, B, C, D, E, F, and G. Remove the cork from bottle A and insert a small piece of manure (taken from the side of a cow), and cork again with the cotton plug. In B, put the scrapings from around the sides of the milk pail or some other dirty milk utensil. To C, add two or three cow hairs. To D, add a few drops of water which has been used to wash the hands. To E, add some particles of straw or hay obtained from the cow stall. Keep F plugged with cotton throughout the demonstration. Uncork bottle G and allow it to stand in the open air. Observe each of these bottles daily and make note of any changes that can be seen in them. Observe also the odor that comes from the contents of each bottle. Discriminate between the sour smell that comes from the normal souring of milk and the putrid or rotten odor that comes from contamination with manure or unclean conditions. What lessons in dairy sanitation does this exercise teach?

EXERCISE No. 23:

Purpose: To make a test of the purity of water supply.

Material: Two four-ounce bottles, some cotton batting and some fresh milk.

Procedure: Scald the bottles and drain. Fill three-fourths full of milk. Insert a cotton plug, stand the bottles in boiling water up to their necks for 40 minutes on three consecutive days. To one add a few drops of fresh spring or well water, to the other add a few drops of barnyard liquid. Place both bottles in a warm spot and observe what happens to each. Usually the milk will curdle within ten to twelve hours when the water is contaminated, the curdling and putrid odor being a safe indication that the water is bad.

DECEMBER: FIRST WEEK

TOPIC: CARE OF THE MILK IN THE HOME—References: Same as for last week.

Suggestions: While there must be cleanliness in the production of milk it is just as important that sanitary methods be observed in its handling in the home.

Lesson Topics: (a) The care of milk in the home. (b) Sanitary handling of milk by dealers. (c) The principles of butter and cheese-making.

EXERCISE No. 24:

Purpose: To study the effect of temperature upon the keeping qualities of milk.

Materials: Four pint milk bottles or fruit jars, scrupulously clean; a quart of fresh milk, and a thermometer.

Procedure: Thoroughly mix the fresh milk and pour equal quantities into each of the four pint bottles or fruit jars. Keep them covered with a cloth to prevent the entrance of dirt. Place one of the bottles in a dish of ice water or very cold well water. Wrap second with a heavy cloth and keep moistened with cold water and place in the shade. Place the third in a dish or pan of water having a temperature of about 60 degrees and place the fourth in a dish of water having a temperature of about 100 degrees F. Try to keep the water surrounding the various bottles at the temperatures mentioned above. Examine frequently and note the length of time it takes the milk to become sour and to curdle.

Suggestion: The experiment should be started in the early morning and the different temperatures mentioned are to be maintained during the day, so far as possible. The pupils should understand that the souring which goes on in the milk is the result of the presence and development of bacteria.

Exercise No 25:

Purpose: To demonstrate the molds which live in cheese and give it flavor.

Materials: A glass tumbler, saucer, a small piece of cheese, and a small, flat stone.

Procedure: Place the cheese in the saucer on the small flat stone, surround the stone with water and invert the tumbler over the cheese and stone and place where it will keep warm. Have the pupils make note of any growth that may occur upon the surface of the cheese from day to day. The molds that develop in cheese and give it its flavor will appear in two or three days. This demonstration suggests that molds and other fungi can be beneficial as well as harmful to man.

Exercise No. 26:

Purpose: To demonstrate bacterial fermentation.

Material: A glass tumbler, and some molasses.

Procedure: To one part of molasses add ten parts of boiled water. Fill the tumbler nearly full with this solution. Add a little manure water to the contents of the tumbler. Set in a window or other warm place. Within 24 hours, bubbles may be observed rising from the liquid in the glass. Fermentation is taking place and is caused by the bacteria which were contained in the manure water. When manure gets into milk which is used for making cheese, this form of fermentation may occur and give rise to what is known as gassy cheese.

DECEMBER: Second Week

Topic: Animal Husbandry—(Text, pp. 192-203.)

Other References: Cattle, 1; 48. Sheep and Goats, 8; 22-A; 175; 177; 186. Swine, 48; 59; 89; 116-D; 184; 224; 236; 244.

Suggestions: Study that type most important in the community or which can be most easily obtained. Have the animal brought to school or take the class to some nearby farm. Make arrangements beforehand with the owner for the use of his stock and have him point out to the class the important judging points of the animal.

Lesson Topics: (a) The important points in the conformation of the animal. (b) Types and Breeds; their origin. (c) Feeding; housing, and care. (d) Marketing the products and by-products.

Exercise No. 27:

Purpose: Sheep—To become familiar with the conformation or judging points of the animal.

Procedure: Become acquainted with all of the parts mentioned in the score card by an actual study of the animal itself.

SCORE CARD FOR MARKET SHEEP

	Perfect Score	Student's Score
General Appearance—Weight, score according to size	8	
Form, long, level, deep, broad, low set, stylish	10	
Quality, clean bone, silky hair, fine skin, light in offal, yielding large percentage of meat	10	
Condition, deep even covering of firm flesh especially in region of valuable cuts. Points indicating condition of ripeness are thick dock, back thickly covered with flesh, thick neck, full purse, full low flank, plump breast	10	
Head and Neck—Muzzle fine, mouth large, lips thin, nostrils large	1	
Eyes, large, clear, placid	1	
Face, short, clean-cut features	1	
Forehead, broad and full	1	
Ears, fine, erect	1	
Neck, thick, short, throat free from folds	1	
Forequarters—Shoulder vein, full	1	
Shoulder, covered with flesh, compact on top, smooth	1	
Brisket, projecting forward, breast wide	1	
Legs, straight, short, wide apart, strong; forearm full, shank smooth and fine	1	
Body—Chest, wide, deep, flesh carried down on sides	8	
Back, broad, straight, even, long, wide, thickly fleshed, ribs arched	10	
Loin, thick, broad, long, even	10	
Hindquarters—Hips, far apart, level, smoothly fleshed	2	
Rump, long, level, wide to tail head; dock plump, oily	3	
Thighs, full, deep, wide	3	
Twist, plump, deep, wide	3	
Legs, straight, short, strong; shank smooth, fine	1	
Wool—Kind, domestic, territory, carpet or blanket		
Class, clothing, delaine or combing		
Grade, fine, medium or coarse		
Quantity, long, dense, even	4	
Quality, fine, pure, crimp close, regular, even	4	
Condition, bright, sound, clean, soft, light	4	
Total	100	

EXERCISE No. 28:

SCORE CARD FOR BEEF CATTLE

	Perfect Score	Student's Score
General Appearance—Attractive appearing, deep, broad, blocky, low set and massive with straight top and bottom lines. Carriage, stylish and vigorous. The bull should be rather heavy in the front quarters and very masculine. A cow should be light in front and show femininity. Weight according to age	10	
Quality—Skin of moderate thickness, mellow and pliable, and not stuck tightly to the body. Thick stiff hide or thin papery hide objectionable. Hair thick and fine, mossy and rather long. Bone rather fine. Covering of flesh, even and not gathered in bunches or patches	10	
Constitution—Chest deep and broad. Crop and fore flank well filled. The nostrils must be large and the appearance of the animal must indicate strength and vigor	10	
Condition—The covering of fat must be thick and even, firm but elastic, never soft and mushy. This point applies mainly to finished beef and show animals	10	
Conformation—Head and Neck:		
Muzzle: broad, mouth large, jaw wide, nostrils large	1	
Eyes: large, clear, placid and prominent	1	
Face: short and broad, showing a good feeder	4	
Forehead: broad, neither sunken nor bulging	1	
Ears: of medium size, fine in texture	1	
Horns: fine in texture, oval, even in size and shape. If polled the poll should be neat and free from scars	1	
Neck: thick and short, throat clean	2	
Forequarters—Shoulder vein, full and smooth	1	
Shoulder: broad but smooth and well covered, blending evenly with the ribs, backbone not lower than tops of the shoulder blades	4	
Brisket: broad, rounding, only fairly prominent	1	
Dewlap: neat, skin not loose and drooping	1	
Legs: very short, straight and fine	2	
Body—Ribs: long and well arched, showing great width and depth of barrel; flesh thick and extending well down on the sides	8	
Back: broad, straight and even	7	
Loin: thick and broad, well covered with flesh	7	
Flank: full and even with the under line	3	
Hindquarters—Hips: wide but smoothly covered with flesh. Mere width of bone without flesh is no advantage	2	
Rump: long, level and wide. Tail head smooth	4	
Pin Bones: far apart but not prominent	1	
Thighs: fleshed to hocks; full and wide	3	
Twist: deep and well filled	3	
Legs: very short and fine	2	
Total	100	

EXERCISE No. 29: SWINE:

SCORE CARD FOR MARKET HOGS

	Perfect Score	Student's Score
General Appearance—Weight: 175 to 225 pounds. Est. (Cut double if over weight).	20	
Condition: Carrying much fat of even distribution	20	
Quality: Firm in flesh; smooth skin; fine straight hair, small clean bone	10	
Dressing Percentage: Maximum development of back, sides, and ham with minimum amount of belly and waste	10	
Form: Long, low set, wide, blocky, with greatest possible proportion of the more valuable parts	10	
Conformation—Head and Neck:		
Face: short and broad indicating a good feeder	3	
Ears: fine	1	
Poll: broad and smooth	1	
Neck: short, thick and smooth	2	
Jowl: smooth and of medium size	1	
Forequarters: Shoulders: broad and smooth but not excessively heavy	2	
Brisket: broad	1	
Legs: short, straight, clean cut tapering bone; standing up well on the toes	2	
Body: Chest: deep and wide; well filled back of the shoulders and in fore flank	4	
Back and loin: long, slightly arched, even in width, broad, showing good spring of ribs	4	
Sides: long and deep; well filled, thick and firm into the corners; ribs long; not pot bellied	3	
Hindquarters: Rump: long, thick and wide; slope to correspond with arch of back	1	
Hams: thick and broad, extending to hocks: twist well filled	3	
Hind legs: short, straight, clean cut tapering bone; standing up well on the toes	2	
Total	100	

DECEMBER: THIRD WEEK

TOPIC: ANIMAL HUSBANDRY—HORSES. (Text, pp. 182-191.)

Other References: 200.

Suggestions: Have one of the pupils bring a horse from home for study and judging practice. If this is not possible, arrange to have a liveryman or breeder bring an animal to school and explain the judging points to the class.

Lesson Topics: (a) The conformation of a horse; names of the different parts. (b) Types and breeds; origin, evolution of the horse; history of the various breeds. (c) Feeding, care and management of horses. (d) Unsoundness and disease.

EXERCISE No. 30:

Purpose: To become familiar with the conformation or judging points of the draft horse.

Procedure: Become familiar with all of the parts mentioned in the score card by an actual study of the animal itself.

SCORE CARD FOR DRAFT HORSES

	Perfect Score	Student's Score
General Appearance—16 points. Weight, over 1,500 lbs. score according to age	4	
Form: broad, massive, properly proportioned	4	
Quality: smooth bone, tendons, lean and set back from bone in legs; skin and hair fine	4	
Temperament: energetic, good disposition	4	
Head and Neck—6 points. Head: lean, medium size; face straight; jaws deep, and wide at throat	1	
Muzzle, fine; nostrils, large; lips, thin and even	1	
Eyes: full, bright, clear, intelligent	1	
Forehead: broad, full; flat in mares and geldings	1	
Ears: medium size, well carried	1	
Neck, muscled; crest, high; throat latch, clean; windpipe, large	1	
Forequarters—25 points. Shoulder: sloping, smooth, snug; extending into back	2	
Arm: thrown back, heavily muscled	1	
Forearm: heavily muscled, long, wide	2	
Knees: wide, cleancut, straight, deep, strongly supported	2	
Cannons: short, lean, wide; sinews: large, set back	2	
Fetlocks: wide, straight, strong	1	
Pasterns: sloping about 45 degrees, long, strong	3	
Feet: large, even size; horn, dense; sole, concave; bars, strong; frog, large, elastic; heel, wide, one-half length of toe, and vertical to ground	8	
Legs: viewed in front, a perpendicular line from the point of the shoulder should fall upon the center of the knee, cannon, pastern and foot. From the side, a perpendicular line dropping from the center of the elbow joint should fall upon the center of the knee and pastern joints, and back of hoof	4	
Body—9 points. Chest: deep, wide, low, large girth	2	
Ribs: long, close, arched wide from backbone	2	
Back: straight, short, broad	2	
Loins: short, wide, thick, straight	2	
Underline: flank low, smoothly muscled to stifle	1	
Hindquarters—34 points. Hips: smooth, wide	2	
Croup: wide, muscular, not much slope to tailhead	2	
Tail: attached high, well carried	1	
Quarters: deep, heavily muscled	6	
Hocks: clean cut, wide, straight	8	
Cannons: short, wide; sinews large, set back	2	
Fetlocks: wide, straight, strong	1	
Pastern: sloping, strong, lengthy	2	
Feet: large, even size; horn, dense; sole, concave; bars, strong; frog, large, elastic; heel, wide, half length of toe, vertical to ground	6	
Legs: viewed from behind, a perpendicular line from the point of the buttock should fall upon the center of the hock, cannon, pastern and foot. From side, a perpendicular line from the hip joint should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line from the point of buttock should run parallel to the point of the cannon	4	
Action—10 points. Walk, quick, long, balanced	6	
Trot: rapid, straight, regular	4	
Total	100	

DECEMBER: Fourth Week

Topic: Feeds and Feeding—(Text, pp. 211-217.)

Other References: 1; 8; 36; 43; 100; 111; 170-A; 178; 200.

Lesson Topics: (a) The food of plants; of animals. How plants get their food; how animals get their food. The plant compounds (starch, fat, protein, etc.) used by animals. (b) How food is digested by cows; by horses; by chickens; by pigs; by men. (c) The balanced ration; what it is. How computations are made. (d) Balanced rations for work horses; dairy cows; laying hens.

JANUARY: First Week

Topic: Farm Management.

Other References: 14; 77; 91; 98; 114; 116; 132; 134-A; 140-A; 156; 174-A; 200; 202; 204; 315; 338; 352; 357; 372; 379.

Suggestion: The work of this week is designed to awaken an interest in the economic and business phases of farming. Encourage the pupils to make such a study of their home farms or of some farm in the community.

Lesson Topics: (a) Methods of selling farm products. Advantages and disadvantages of selling through commission merchants; cooperative associations; direct (parcel post). (b) Some typical successful farms; methods used; equipment, profits.

Exercise No. 31:

Purpose: To make a map of the home farm and to locate the fields so there will be the greatest efficiency of time and labor in fencing, planting, cultivating and harvesting the crops.

Procedure: (a) Draw a map of the home farm to scale. Indicate thereon the fields, pastures, woodlot, orchard, etc. Show, by writing in the space occupied by each field, what crops have been grown there during the past four years. To make the most efficient use of farm machinery and labor, the fields should be laid out in rectangles whenever possible. In any event, every field should have square corners. Pastures and wood lots can be most cheaply fenced when they are square. On many farms there are low or wet spots needing drainage, stumpy places needing clearing, etc., which break up the regularity of the field and cause much extra labor. While such changes cannot be made in a year, the farm owner should have definitely in mind some ultimate plan which will enable him to utilize both his land, labor and machinery in the most efficient manner. (b) Make a new ideal plan for the home farm, showing all of the changes in the field line and rotation plan, that you think should be made. (c) Make an inventory of the home farm, listing all of the livestock, implements, lands, crops, etc., and giving the value of each. (d) Determine the amount of the owner's capital and find out what the interest on that capital would be at 6 per cent. Subtract the amount of the interest from the farmer's net income. The amount that remains, represents the farmer's income or the money he has received for his year's labor. The net income is the amount that remains after the sums paid for hired labor, fertilizer, seed, taxes, depreciation of buildings and machinery, etc., have been subtracted from the farmer's gross income. The gross income is the money received for crops, livestock, etc.

JANUARY: Second Week

Topic: Farm Machinery—(Text, pp. 232-234.)

Other References: 101; 110-B; 204.

Suggestions: Two important ideas are to be developed in connection with this topic. The first is the enormous loss suffered by farmers because of the mistreatment of their farming implements. The second is the effect improved farm machinery has had upon farming and upon civilization.

Lesson Topics: (a) Discuss the evolution of the plow and other tillage implements, and the effect upon agriculture. (b) Discuss the evolution of wheat harvesting machinery; the effect upon food prices. (c) The care of farm implements; the average life and the possible life of grain binders, mowers, harrows, etc. Annual loss to farmers due to neglect.

Field Trip: Take the class to some implement house so they may become familiar with the latest type of farm implements. Arrange in advance with the dealer and induce him to give the class a talk on the uses of the various kinds of plows, cultivators, etc.

Exercise No. 32:

Purpose: To become familiar with the different types of farm implements and the uses of each.

Procedure: Have the pupils make a list of different kinds of tillage implements they should buy for orcharding, general farming, special farming (market gardening, etc.). Reasons should be given for the selection. Implement catalogues can be obtained free from any dealer, and these should be placed in the school library.

JANUARY: Third Week

Topic: Forestry.

Other References: 44; 67; 107; 114-A; 128; 143-B; 144; 200; 202; 204; 311; 317; 361; 378.

Suggestion: The great forest wealth of the Pacific Northwest deserves at least a week's intensive study. The true meaning of conservation and the relation of the forest cover to erosion, stream flow, irrigation, floods, etc., should be brought out. The annual losses caused by forest fires; their cause and prevention, should also be considered.

Lesson Topics: (a) The important forest trees of the State, the acreage, value and use of the different woods. (b) Destructive and constructive lumbering. Cite examples. (c) The principles of forestry. (d) Utilization of forest waste; forest by-products. (e) The cause and prevention of forest fires.

EXERCISE No. 33:

(Demonstration.)

Purpose: To demonstrate that the spongey nature of the forest floor aids in retaining the rainfall and checking floods.

Procedure: Prepare a mound of loose fresh earth two to three feet in diameter at the base and from 20 to 30 inches high. Pack the mound quite solidly so as to approximate the natural condition of the earth's surface. Cover over one side of this mound with moss or leaves, being sure that no spots are left exposed. Thrust small twigs of evergreens into the moss so as to make a miniature forest on that side of the mound. Leave the other side bare. Take a sprinkling pot and sprinkle water upon the mound, first on the "forest" side, then on the barren side of the mound. Let the water fall from a distance of about three feet. Note how the water gullies the bare slope, running off in muddy streams at the base of the mound, while on the "forest covered" slope the water remains clear and no erosion takes place. Note also that the water runs off more rapidly on the bare side than it does on the other. With these facts in mind, what do you think would result if the forests were removed from the mountain sides?

JANUARY: FOURTH WEEK

TOPIC: HORTICULTURE—Orcharding. (Text, pp. 88-93.)

Other References: 4; 25; 37; 39; 42; 55; 60; 62; 145; 146; 146-D; 189; 200; 202; 204; 310; 313; 363.

Suggestions: The pupils should become familiar with the different fruit sections of the State (the elevation, kinds of soil, varieties grown, etc.). If orchards are available, arrangements should be made so the pupils can observe or get practice in pruning.

Lesson Topics: (a) The fruit districts of Oregon; the best varieties to be grown in each. (b) The fruit sections of the United States; the best varieties; markets; methods, etc. (d) The Why and How of Pruning. (c) Methods in planning and planting orchards. Selection and care of young trees.

EXERCISE No. 34:

Purpose: To plan a good home fruit orchard suitable to the section in which the pupil resides.

Materials: A ruler, sheet of paper and some of the references given.

Procedure: Make a list of all the varieties of tree fruits and small fruits that can be grown in your section. Re-group these varieties according to their season or time of maturity. Draw to scale a one-acre home fruit orchard, and another of five acres. Indicate on these maps, by crosses and dotted lines, the location of the various fruit trees and rows of small fruits that have been selected. The selection should be so made that early, medium and late varieties of each kind of fruit will be included.

FEBRUARY: First Week

Topic: Horticulture—Home Garden Planning. (Text, pp. 179-180; 247-267.)

References: 13; 37; 55; 64; 79; 80; 81; 92; 94; 133; 143; 200; 204; 220.

Suggestions: "A garden for every home and a child for every garden." There is no one activity of the school, especially so far as the agricultural work is concerned, that will produce such immediate effects in the home, as will practical work in gardening. A well-planned garden can be made to yield a good vacation income for children, can help reduce the cost of living and will give boys and girls excellent training in practical agriculture.

Lesson Topics: (a) The need of garden planning. Meaning of companion cropping; succession cropping. (b) Study of seed catalogues. Selection of varieties best suited to soil, climate and season of year. (c) Methods of starting or forcing plants under glass. Crops to be sown and transplanted. (d) Hot-beds and cold frames. Principles; construction; use.

Exercise No. 35:

Purpose: To plan the home garden so there may be a continuous and bountiful supply of vegetables with the least possible labor and cost.

Materials: A ruler, pen or pencil, sheet of paper and seed catalogue for each pupil. (Each pupil should bring a seed catalogue from home or write for one.)

Procedure: Determine the size of the garden in feet and then draw the garden to scale (4, 8 or 16 feet to the inch). Select the vegetables desired for the early garden, the summer garden and for fall and winter. Look up the cultural directions given for each variety in the seed catalogue. Indicate, by dotted lines on the garden map, the rows closely planted crops are to occupy; and, by X, the places in the rows occupied by such plants as squash, melons, tomatoes, cabbage, etc. So plan the planting scheme that the greatest possible amount of vegetables can be produced. This is done by *companion cropping* and *succession cropping.*

Explanation: By companion cropping we mean the planting of such rapid growing vegetables as radishes, lettuce, onion sets, greens, etc., between such slow growing plants as cabbage, melon, cauliflower, tomatoes, etc., which require considerable room when mature, but leave much vacant space in the rows when young. Succession cropping means the constant utilization of the garden by planting some new crop as soon as another has matured. For instance, early peas may be followed by late peas or cabbage, celery, etc. The seasonal requirements of varieties must also be taken into consideration, for varieties which may do well in early spring might be a failure in late summer or fall.

FEBRUARY: SECOND WEEK

TOPIC: HORTICULTURE—Landscape Gardening; School and Home Ground Beautification. (Text, pp. 268-283.)

References: 33; 49; 53; 64; 75; 148-A; 200.

Suggestions: The study of landscape gardening should have a practical application. Definite plans for the improvement of the school and home grounds, should be made and followed. The necessary seeds and shrubs can be obtained at little or no cost and the school made a place of beauty.

Lesson Topics: (a) The principles of landscape gardening. (b) The selection, propagation and care of ornamental plants and shrubs. (c) The selection, planting, and culture of shade trees. (Select the trees and prepare the ground now for Arbor Day planting.)

EXERCISE NO. 36:

Purpose: To make working plans for the landscaping of the school grounds.

Materials: Each pupil should be supplied with a ruler, pencil, sheet of paper. Two or three nursery catalogues should be obtained for the use of the school.

Procedure: Each pupil is to draw the school grounds to scale, locating the school and outbuildings in their proper places on the map. Keeping in mind the principles of landscape gardening, and after careful study of the descriptions of the various flowers, shrubs and trees given in the catalogue, each pupil should indicate on his map the places where he should place each plant or group of plants. The principles of color, harmony, and design should be kept in mind. All slopes, ditches, wells, trees, etc., on the school grounds should be indicated on the map.

Suggestions: The teacher should send the best maps of the school grounds to the Professor of Landscape Gardening, Oregon Agricultural College, who will criticise the drawings and give suggestions. By a liberal use of the native flowers, shrubs and trees, the school grounds can be beautified at very little expense.

EXERCISE NO. 37:

Purpose: To make working plans for the beautifying of the home grounds.

Materials: Same as in the previous exercise.

Procedure: Same as in previous exercise, only the pupils are to use their own homes as the basis of the work. A list of all the trees, shrubs and flowers which grow well in the neighborhood, should be made and grouped according to their suitability for fence rows, driveways, borders, beds, etc.

Suggestions: A practical bearing can be given this work by encouraging a flower-growing contest among the children. The flowers are to be grown at home and an exhibit can be held next fall as soon as school opens.

FEBRUARY: Third Week

Topic: The Country Home and its Surroundings—(Text, pp. 240-246.)

References: 27; 49; 117-A; 119-A; 143-A; 143-B; 145-B; 145-F; 200; 362.

Lesson Topics: (a) How can the farm home be supplied with good pure water? Describe various methods for disposing of the sewage from the farm house. Tell about the disposal of sewage in our cities. (b) What farm buildings are best made of concrete? Of wood? (c) Compare the advantages and disadvantages of country life with those of the city. (d) Describe the farm house conveniences and labor-saving appliances that should be found in every farm home.

Exercise No. 38:

Purpose: To study and plan the farm home from the standpoint of efficiency and sanitation.

Procedure: (a) Each pupil should draw to scale a plan of his own farmstead or that of a neighbor (a farmstead includes the houses, outbuildings, barnyard, pig pen, poultry yards, flower and vegetable gardens, and the lawn or meadow near the house). (b) Each pupil should next draw the plans of an ideal farmstead, having the farm buildings arranged so that they will be most convenient and accessible. There should be a proper distance between house and barn, poultry yard, and pig pens, as well as ease of reaching the fields. (c) Compare the best ideal and the best actual farmstead plan and show where changes can be made in each to advantage.

Suggestions: The farmstead should be conveniently arranged, practical in the grouping of its farm buildings, sanitary as regards its water supply, sewage disposal and manure piles, and beautiful in its general setting.

FEBRUARY: Fourth Week

Topic: Poultry Husbandry—Hatching and Rearing Chicks. (Text, pp. 204-207.)

Other References: 69; 93; 162; 163; 173; 176; 180; 200; 218; 233.

Suggestion: The pupils who are interested in poultry should be encouraged to set one or more hens at home. If the loan of a small-sized incubator can be secured, run it at school and let each pupil take turns in tending the machine.

Lesson Topics: (a) Management of setting hens or incubator. (b) The housing of young chicks (fireless-brooders; hen-brooders and other home-made shelters). (c) The care and feeding of young chicks. (d) The care and feeding of pullets and breeding stock. (e) Marketing surplus roosters. The preservation of eggs. (Cold storage, water glass, lime water, etc.)

MARCH: First Week

Topic: Crop Production—Wheat, Corn, Potatoes. (Text, pp. 163-168.)

References: 5; 68; 70; 78; 110; 114-D; 117; 118-B; 122; 124; 126; 131; 164; 165; 320; 335; 360; 372.

Suggestions: Study the crop of most importance in your community. Encourage the Industrial Club members who are undertaking the corn or potato projects to tell the class what they know regarding corn and potato production.

Lesson Topics: (a) Selection, preparation and treatment of seed. (b) The proper preparation of the seed bed. (c) Methods of planting. (d) Cultivation and irrigation. Disease control.

Exercise No. 39:

Test seed corn by the blotter, "rag doll" or sand-box method.

Purpose: To determine the viability or germinating quality of corn (or any other field or garden seed) by the sand-box method. (See reference No. 124.)

Materials: A shallow wooden tray two inches deep inside, 20 inches wide and 24 to 30 inches long (this can be constructed by the pupils out of cracker boxes). Stout twine, carpet tacks, a ruler and pencil and sand enough to fill the tray.

Procedure: Fill the tray level full with moist sand. The surface of the sand should then be divided into little two-inch squares by driving the tacks on the outside of the tray and lacing the twine back and forth across the top. Each square should be numbered by beginning at the lower lefthand corner and numbering up in the perpendicular rows, running from left to right across the tray. Next lay out the seed corn ears or samples of other seeds, whose viability is to be tested. Arrange them in a row where they will not be disturbed and number them. In testing the seed corn, remove six kernels from each ear with a pocket knife. Take one kernel each from near the tip, middle and butt on one side of the ear, then turn the ear over and take three kernels in like manner from the opposite side of the ear. Imbed these kernels, point down, in the sand, in the square corresponding to the numbers of the ears. Thus six kernels from ear No. 1 will go in square No. 1, etc. After all the kernels have been planted, spread a moist cloth over the tray. On top of this place two wet burlap bags, care being taken to see that the burlap is pressed down tightly at the corners and along the sides so that all the kernels are kept uniformly moist. Place the box near a stove where it is warm and where the temperature never goes below freezing. Do not let the burlap dry out. Within four to seven days, depending on the temperature at which the box is kept, the kernels will have germinated sufficiently to permit the selection of the best ears for seed. Remove the bags and cloth. The kernels in each square should be examined. Those from some ears may not germinate at all; others may do so, but very weakly, and still others will be found to have germinated vigorously with strong healthy sprouts. Only the ears represented by the latter should be saved for seed. All others should be discarded. Samples of other varieties of seeds may be tested in a similar manner.

MARCH: Second Week

Topic: Legumes—Alfalfa, Clover, Vetch, Peas, etc. (Text, pp. 290-297.)

Other References: 52; 66; 83; 88; 90; 102; 104; 109; 112; 116-B; 131; 139; 140; 146-A; 149; 158; 246; 248; 367.

Suggestions: Legumes of some kind can be grown in nearly every part of the State. The type most common and valuable in the community should be studied in the school.

Lesson Topics: (a) Kinds and value of the legumes grown in the county; in the State. (b) The legumes are nitrogen gatherers. Meaning and importance of this fact. (c) The root nodules or tubercules. The nitrogen-gathering bacteria. (d) The place of legumes in the diet of farm animals; in the crop rotation plan.

Exercise No. 40:

Purpose: To study the roots of legumes.

Material: A collection of as large an assortment of legumes, roots intact, as can be obtained (white, red and sweet clovers, beans, peas, alfalfa, vetches, etc.). The plants should be carefully dug, not pulled up.

Procedure: Examine the roots of the legumes collected for the nodules or tubercules. What is the shape of the nodules on the various plants? Make a drawing of the roots of some common legume and show the nodules.

Exercise No. 41:

Purpose: To become familiar with the character of clover or alfalfa seed and some of the adulterants.

Material: A one-ounce sample of clover or alfalfa seed for each of the pupils may be obtained from the homes of the pupils, or purchased at a seed store.

Procedure: Place the seed sample on a sheet of white paper. Separate the large, plump legume seeds from the small, shriveled or broken seeds and other material. Make four groups of seeds as follows: Large legume seeds. Small or broken seed. Weed seed. Inert matter (chaff, etc.).

Suggestions: If the seeds examined appear to contain much foul matter, send a sample to the Seed Testing Laboratory, O. A. C., and the names of the weed seeds and per cent of foul matter will be sent back.

MARCH: Third Week

Topic: Plant Study—Conditions Essential to Plant Growth.

References: 123; 124.

Suggestions: The work of the week is to consist of the exercises outlined for each day. As it will take more than the regular amount of class time to set up some of the exercises, pupils should be permitted to work on them as soon as they have their lessons. Some of the exercises may take several days for their completion, and the pupils should be required to make daily reports on the progress or outcome of each one.

Exercise No. 42:

Purpose: To study the effect of light upon plant growth.

Material: Two flower pots or tin cans provided with drainage holes, a paper cone to cover one, and some seed of garden peas or beans.

Procedure: Plant two pots in just the same way, with either peas or beans. Place them under conditions where they will have the same temperature and give them the same amount of water. Place one of the pots in a window where it will make a normal growth, and over the other place the paper cone, which will exclude light. At the end of a sufficient time, or better still, at frequent intervals during the growth of the plant, observe the appearance of the two sets of plants under these different conditions. After the plants from which the light has been excluded have grown to several inches, remove the covering and note what changes take place in the appearance of them after they are placed in full sunlight.

Suggestions: Recall the way in which plants growing in a poorly-lighted room search for a window. Recall the sprouting of potatoes in a cellar. Notice the effort which forest trees, growing close together, make to send their branches up into the light. Trees which are growing close together grow much taller and more spindling than other trees of the same kind growing in open conditions. Would there be any difference in the value of the wood for commercial purposes from trees of the same kind grown under closely shaded and open conditions? Explain fully.

Exercise No. 43:

Purpose: To study the effect of heat upon plant growth.

Material: Several flower pots or tin cans; soil to fill these; some radish seed, and a thermometer.

Procedure: Mix earth of pots or cans which will be treated just alike and in which seeds of radish will be sown. Set these outdoors and cover one entirely with a pane of glass, leaving just a small crack for ventilation, and leave the other can open. Place a themometer in each, so that the temperature may be recorded, and then note several times a day for two or three weeks, the appearance and development of the plants under the two different conditions.

Suggestions: Conclusions may be drawn in this way concerning the relation of heat to the germination and growth of the plant. Keep notes in tabular form, noting the temperatures, and the average growth of the plants. Is it possible to become so cold that seeds will not germinate and plants grow? May the temperature be too high for growth? From your observations on these experiments what would you say would be the most desirable temperature for the growth of radish?

EXERCISE NO. 44:

Purpose: To study the effect of air upon plant growth.

Material: Three tumblers, soil to fill these, preferably containing considerable clay, a few seeds of beans and peas; two wide-mouthed bottles, and cuttings of some plant, such as coleus, geranium or wandering jew.

Procedure: (a) To illustrate the necessity of air for germination, fill the three tumblers mentioned with soil in the ordinary way, having it moderately moist. In one, plant one-half dozen seeds of beans or peas, whichever may be used, and allow it to sit in the room and grow under ordinary conditions. Plant the second tumbler in the same way but keep the soil saturated with water so that there is a thin film of water standing over the top of the soil, in this way excluding the air from between the soil particles. Treat the third tumbler in the same way, only instead of leaving it in the room at ordinary temperature, put it outside where the temperature is rather low. At the end of a sufficient time note in which tumbler the seeds have germinated first. (b) Boil some water to drive out the oxygen, or air, place in two wide-mouthed bottles, cover one with a thin layer of oil to prevent air from entering. Insert a cutting of whatever plant is used through a piece of cardboard which exactly fits over the top of the bottle and allow it to project down into the water. Note the effect of the absence of air on the growth of the roots.

Suggestions: Ask yourself these questions: May a soil become so wet that not enough air will be found between the particles of the soil to allow seed to germinate? What happens to seeds when they are kept in a cold, wet soil? What is the effect of the absence of air in the soil on the growth of roots? Why is air necessary for germination?

EXERCISE NO. 45:

Purpose: To study the effect of water upon plant growth.

Material: Two flower pots or tin cans, some soil and any common garden seed.

Procedure: Fill the pots with soil and plant the seed. Have them grow under exactly the same conditions, except that water is withheld from one pot for several days during the time the seed is germinating and again after the seedlings get to be some size. Make a record of the differences which are found in the two pots.

Suggestions: What is the effect of withholding water from seed before they have germinated? What is the effect of a lack of moisture on growing plants? Why is it that plants do not thrive well during drouth?

EXERCISE No. 46:

Purpose: To study the effect of food upon plant growth.

Materials: Plant 100 wheat grains in a germinator (moistened blotters between two plates) one week before the exercise is started; nine tomato cans, tops removed and provided with drainage holes; two gallons of clean, dry sand; two ounces each of sodium nitrate; acid phosphate; muriate of potash, and a pint of dry, well rotted manure (enough of the three commercial fertilizers mentioned for use in this exercise can be obtained from a drugstore or seed house for 10 cents).

Procedure: Fill eight of the nine cans full of clean, dry sand. Label the cans A, B, C, D, E, F, G, H and I, respectively. Empty the contents of can B on a newspaper; thoroughly mix one ounce of sodium nitrate with this sand and replace mixture in the can. Treat the contents of can C in a similar manner, using one ounce of acid phosphate instead of the nitrate. Do the same with can D, using the potash instead of the nitrate or phosphate. Mix one ounce each of the phosphate, nitrate and potash fertilizers with the contents of can F. Refill can G with a mixture consisting of one-half sand and one-half finely pulverized manure. Fill can H with rich garden loam. Cans A, E and I will contain nothing but the pure sand. Plant five vigorous wheat seedlings (taken from the germinator) one-fourth inch deep in each can. Water each can with pure rain or well water three times a week, using a half teacupful each application. At the end of three weeks, compare the growth of the plants in the different cans, noting especially their color, vigor, height and root development.

Suggestions: At the end of the experiment, the following questions should be asked: What effect upon the growth of plants has a soil containing no plant food? What is the effect of the omission of each one of the principal plant food elements from the soil in which the plant is growing? Which seemed to be the most important fertilizers? What are the sources of the plant food elements in nature? If a farmer's land were lacking in nitrogen, what would be the most inexpensive method of supplying it?

MARCH: FOURTH WEEK

TOPIC: HORTICULTURE—Planting the Garden. (Text, pp. 247-267.)

References: 35; 37; 80; 134; 200.

Suggestions: The class work of this week should be based as far as possible upon the work the pupils are doing in their school or home gardens.

Exercise: Care *versus* carelessness in transplanting cabbage, tomatoes, celery, etc. Soaking of seed. Depth and method of planting.

Lesson Topics: (a) Fertilizing and preparing the seed bed. (b) Methods of planting and transplanting. (c) Cultivation and thinning. (d) Irrigation; right and wrong methods.

EXERCISE NO. 47:

Purpose: To demonstrate some practical methods in gardening.

Materials: Young cabbage, celery or tomato plants. One-half pint bean or pea seed. Small quantities of radish, lettuce, onion and pea seeds.

Procedure: (a) Having started some cabbage, tomato or celery plants in flats or in a hot-bed, transplant half of them very carefully, first moistening the soil so the earth will cling to the roots. Carefully lift the plants so the roots will be as little disturbed as possible. When transplanting, pack the dirt tightly about their roots and trim the leaves back so that the roots will be able to supply the remaining leaves with enough water. Transplant the rest of the plants without taking any of these precautions. Which plants do the best? If you were planting for commercial purposes, which method would you use? (b) Soak some bean or pea seed over night and plant half a row in the garden, finishing the row with dry, unsoaked seed. Which came up first? Which made the stronger and better growth eventually? (c) Plant a row of radish, lettuce, peas and onions, dividing each row into four sections. In section 1, plant the seeds to a uniform depth of three inches; section 2, to a depth of two inches; section 3, to a depth of one inch, and section 4, to a depth of one-half or one-fourth inch, depending upon the size of the seeds. Note how long the seeds in the different sections were in coming up. Did any fail to come up at all?

APRIL: FIRST WEEK

TOPIC: PLANT STUDY—How Plants Feed. (Text, pp. 27-35.)
Other References: 123; 124.

EXERCISE NO. 48:

Purpose: To show that plants get water from the soil and not from the air.

Material: Two tin cans, with drainage holes; some fine garden soil from which pebbles and clods have been sifted out; a few kernels of corn.

Procedure: Fill each can with soil, tamping it down well so as to have it about the same consistency in each can. Plant six kernels of corn in one of the cans. Water both cans just alike so that the soil in each will contain the same amount of water. Do not allow the soils to dry out. As soon as the corn plants attain a height of four to six inches, water each can thoroughly; and as soon as the water has ceased draining from each, weigh and record the weights. Continue to weigh each pot at frequent intervals, and note which one decreases in weight more rapidly.

Suggestions: This will enable one to tell which one of the jars is losing weight from the consumption of moisture. If water is withheld from each of the jars for a time after the plants get started to growing, a perceptible difference in the drying out may be noticed. If the soil in the pot which contains the growing corn dries out more rapidly, what has become of the moisture? If the moisture was being taken up by the plant from the air, would not the weight of the pot containing the corn increase rather than decrease? As the corn increases in size, does it use more or less water? Allow the soil to become dry in the can and note the effect upon the corn. Describe the appearance of the leaves of a corn plant in a field during a drouth. What does this mean?

Exercise No. 49:

Purpose: To show how food and water get into the roots of plants.—(Osmosis.)

Materials: (1) A piece of glass tubing 12 inches long of ⅛ to ¼ inch diameter. (If you cannot obtain this tubing locally, write to the Department of Agricultural Education, Oregon Agricultural College, Corvallis, and a piece of tubing will be sent free.) (2) Two sausage skins 4 to 6 inches long and ½ to 2 inches in diameter. (These may be obtained by purchasing the ordinary link sausage that have a thick skin or membraneous covering and carefully removing the contents with the fingers, being careful not to rupture the membrane. If these skins are soaked in water for a few minutes they may be turned inside out and all of the meat particles removed.) (3) A quarter cup of syrup or granulated sugar. (4) A can or lard pail provided with drainage holes; a shallow dish; soil.

Method: (a) See that one end of the sausage skin is securely tied. Fill the sack thus formed nearly full of the syrup, or half full of sugar and then add water enough to nearly fill. (b) Insert the glass tubing into the sack opening to a depth of one inch and then tie the top of the sack to the tubing. Two such membraneous sacks should be prepared. (A) Suspend one sack half its length in water, supporting the tubing so that it will stand perpendicularly. When this sack is placed in the water, the contents of the sack should just fill the lower inch of tubing. Observe the apparatus every fifteen minutes and note the rapidity with which the liquid rises in the tubing. (B) Bury the other sack in an upright position in a can of garden soil. Support the tubing with a stick so that it will remain perpendicular. Moisten the soil until drainage begins, then place the can into a shallow dish of water. Note the rapidity and height to which the liquid rises in the tubing.

Application: It is easy to perform an osmosis experiment but often hard to explain to students. This exercise, it is hoped, will make such an explanation much easier. Water gets into the roots of plants through the root hairs. The root hairs are tiny little sacks very much like the sausage skin, filled with a liquid comparable to the syrupy solution. No holes exist in either the membraneous walls of the root-hairs other than the opening into the main root cells, or in the membraneous sausage skin, so far as the microscope reveals, and liquids can pass through only by that process called osmosis. That dissolved mineral substances can also osmose through the membrane can be demonstrated by putting a little ink in water outside of the sack and then noting the change of color of the liquid in the tube. The sausage-skin sack mentioned in Exercise B, roughly approximates the structure and function of a root hair. The sack and sugar solution represents the root hair and cell contents, while the glass tube is the opening into the plant roots. The long glass tube is used simply to demonstrate the pressure or force that osmosis exerts against gravity. When the sack is buried in soil, kept moistened by the capillary rise of water from below, we have demonstrated, on a large scale, what is occurring in the thousands and millions of little root hairs on each plant.

EXERCISE No. 50:

Purpose: To show what becomes of the water absorbed by plants. (Transpiration.)

Material: Any plant which has been well started in a tomato can and is now several inches high. Select some plant which has considerable leaf area. An ordinary glass tumbler and a piece of cardboard.

Procedure: Cut a slit in the piece of cardboard and draw it around the plant and allow it to rest on top of the can. Over this place the tumbler and seal all the places where air might escape with sealing wax or paraffin. After the tumbler has been over the plant for several hours, or possibly over night, note the collection of drops of moisture on the inside of the tumbler. During the day keep the apparatus sitting in a bright sunny place.

Suggestion: Where did this moisture come from? Was it originally in liquid form? Why does it collect in drops on the cool glass tumbler?

EXERCISE No. 51:

Purpose: To show how water circulates in plants.

Material: A tumbler containing water to which a few drops of red ink or other brilliant dye has been added. Cuttings of any herbaceous plant, such as geranium or coleus, or flowers with long stems, preferably white flowers as carnations or lilies of the valley.

Procedure: Stand the freshly cut ends of the flowers or stems in this red liquid and note that in a short time the color will rise through the stem and be distributed in the white petals of the flower through the veins or through the young stems and carried out in the young leaves. Hold the petals and leaves up to the light and note the pattern of the veins which is now outlined in red.

Suggestions: If water containing red ink will travel in this way out into the petals and leaves of the plant, would water containing plant food travel in the same way? Note the difference of time which it takes in the different plants used, for the water to travel a given distance. In this way a rough estimate may be obtained of the rate at which plant food is distributed through the stem of a plant.

Exercise No. 52:

Purpose: To show that plants get food from the air.

Material: A few pieces of green wood, some soil, a tin box with holes in the top and an iron spoon.

Procedure: Put in the covered tin box with small holes in the top fine pieces of small twigs of some green wood and hold it over a hot fire until all the gas and smoke has been given off. Note the color and consistency of what remains. Apply a match to this. Will it burn? This is charcoal which is made almost entirely of carbon. Treat this by boiling in water and in a weak acid, such as vinegar. See if it can be dissolved. After these experiments, what would be your conclusion as to whether or not much soil material can be dissolved by soil water. Take a tablespoonful of soil and heat it red hot in an iron spoon. Was there much carbon in the soil? Nearly one-half of the solid material of the plant consists of carbon and it will be seen that there would not be nearly enough carbon in the soil to supply its needs. Hence the carbon must come from some other source. Take the charred sticks which were heated in the tin box in the first part of the experiment, place them in the spoon and heat them until only the ash remains. What has become of the carbon? It has been given off in the shape of gas called carbon dioxide, from which source plants may take it in through their leaves. Plants then discard most of the oxygen of the carbon dioxide and retain the carbon which it builds into new plant structures.

Suggestions: If so large a proportion of the plant's body consists of carbon, why is it that the supply of carbon dioxide does not become exhausted on the earth? What are the sources of carbon dioxide in nature? Compare the effects of carbon dioxide on plant and animal life.

APRIL: Second Week

Topic: Plant Study—How Plants Grow and Multiply. (Text, pp. 77-80.)

Other References: 123; 124.

Suggestions: An intensive study of plant propagation should be made this week. The vegetables, flowers, shrubs and trees that grow in the pupils' yards should be utilized as far as possible.

Exercise No. 53:

Purpose: To study how the plant grows from the seed.

Material: A glass jar or box with a glass side, and seeds of peas, beans, corn, squash, and also some small seeds such as radish, clover, turnip, etc.

Procedure: Plant the seed in soil at varying depths against the side of the jar or box so that the growth or sprouting may be observed from the outside. Seeds of the small kinds may be planted at various depths and the effects of the depths of planting may be noticed and the length of time which it takes a seedling to reach the surface. Since these young germinating seeds are not able to take their food from the soil and from the air as has been found in previous exercises, what are the sources of food? Where does the food come from which causes the seed to germinate and the young seedlings to make their first growth? This may be illustrated by taking a bean seedling which has just pushed through the ground and with a sharp knife take off the two half-beans, leaving intact the growing portion. Others should be left intact so a comparison can be made between those having the seed leaves removed and those which are growing normally.

Suggestions: Compare the effect of the different depths of planting on each of the several kinds of seeds used. Which part of the seedling breaks through the seed coat first? Is it the root or the stem? Do all seeds have stored food? Where is it stored in the seed? What kind of food is this? Of what use is it to the plant?

Exercise No. 54:

Purpose: To show the propagation of plants by means of spores.

Material: Some bread which has been kept moist and allowed to stand in the open air of the room for several days. A growth of mold will develop on it, which, after a short time will become covered with little black knobs elevated on stalks. Each one of these knobs is a spore case which contains numerous spores shaped something like a grain of wheat. Other material which may be used is any common fern which is fruiting, that is, has on the back of its leaflets little dark brown patches or spots which are made up of clusters or spore cases.

Procedure: Put these under the microscope or hand lens, if possible, and note their shape, appearance, size, etc. Then collect certain spores from the material which you are studying and if bread mold is being used place these on another piece of moist bread from which all other air is being excluded, that is, put it under a glass jar or cover, or something of that nature and note the development of mold from the spores.

Suggestions: The spores which are found on fern or on the bread mold take the place of seed in the higher plants, that is, they are the means by which the plant is propagated and they germinate and grow into new plants in a manner similar to which seed germinate and grow into new plants. It is a well known fact that bread will mold if exposed to ordinary air and kept moist. Why?

EXERCISE No. 55:

Purpose: To study propagation by natural division; buds, corms, tubers and stolons.

Material: Maple buds, an onion, a corm of crocus, gladiolus or Indian turnip, strawberry plants.

Procedure: Study each of these structures indoors as well as outside wherever possible. Cut the bud lengthwise. Note the number of small scales, leaves which fit close together over the growing point in the center. In the spring of the succeeding year this growing point will continue to elongate and push its way out from between the leaves, which by that time will expand and in this way the growth of stem and leaves is provided for the succeeding year.

The bulb consists of a number of close fitting layers or leaves which surround the growing point in the center. The onion is a good example. Cut lengthwise and study.

A corm resembles the bulb in appearance but has this difference, in that it is solid throughout. Study some corm, making lengthwise sections through it. Study the inner structure.

Stolons are runners which grow from one plant to another or start from a plant and run along the surface of the ground and root at the joints. At this place another plant springs up, and then it runs along the ground and takes root a short distance further on. The strawberry is a good example of this. Study these plants out of doors in their natural growth as far as possible.

Suggestions: After a study of these four different means of propagation of plants, which do you think would be the most effective or the most likely to succeed in its purpose in nature? Why is it an advantage to a plant to have more than a single means of propagation? Is the same plant ever propagated by seeds and spores? Is the same plant ever propagated by seeds and tubers? By bulbs and seeds? By seeds and stolons?

EXERCISE NO. 56:

Purpose: To study propagation by artificial division; hardwood and softwood cuttings and layering.

Material: Hardwood cuttings are obtained from the ripened wood of some deciduous plant of the same or previous year's growth. Cultivated plants commonly propagated by means of hardwood cuttings are grape, currants and gooseberries, and also some ornamental shrubs such as privet, etc., and some trees as willows, poplars and some conifers. Softwood cuttings are well illustrated by the "slips" which are used to propagate a number of house plants. Many greenhouse plants such as roses, carnations, geraniums, begonias and the like are propagated in this way. Also some vegetables such as potatoes, when grown in greenhouses, sweet potatoes, etc.

Procedure: Soft wood cuttings should always be started in sand on account of the fact that ordinary soil is liable to cause mold. Hardwood cuttings may be started in ordinary greenhouse soil. Preferably, cuttings should have about three buds. Start them indoors, with the exception of grape, which may be started out of doors by burying the basal ends several inches in the soil.

In propagating by means of soft wood cuttings most of the leaf surface should be removed so as to lessen the amount of transpiration, otherwise more water will be given off from the plant than the cut end in the soil can take up, until it has developed a root system. A layer is a branch so placed in contact with the earth as to induce it to throw out roots and shoots, thus producing more independent plants, the branch meanwhile remaining attached to the parent plant, which after a time is cut off and left to grow independently.

Two kinds of layering are practiced. Tip layering is illustrated by the black raspberry, the tips of the canes being bent over and covered with earth so that they will send out roots and shoots. After the plant has been well formed it is cut off from the parent plant. Vine layering is used sometimes in the propagation of grapes. Branches which come out near the ground are trained along the surface, and covered with earth. Shoots start from along this branch. It is a sure means of propagation in this plant. If opportunity permits, some plants may be propagated by the pupils in this manner.

Suggestions: Compare propagation of plants by means of hardwood and softwood cuttings with propagation by means of seed, as to certainty of reproduction, rapidity with which new plants may be obtained, and the amount of labor required.

EXERCISE No. 57:

Purpose: To study propagation by artificial division: budding and grafting.

Materials: Some twigs of peach or apple trees, a knife for budding or grafting, some raffia for wrapping and some grafting wax.

Procedure: The instructor should explain the different methods of grafting, and should demonstrate these before the class begins to do any of the work.

The principle of grafting or budding is simply the bringing together of two portions of two different individual plants, usually of the same species, so that the cambium layers or growing portion will be brought into contact with each other.

That portion of the plant which contains the root is known as the "stock" and the upper part which is grafted on to this is known as the "scion." Peaches and apples may be reproduced either by grafting or budding. It is important to see that the two portions after being fitted together are wrapped with some material which will not cut through the bark and will hold them firmly together so that they may grow quickly. The graft union is covered with wax made especially for the purpose (grafting wax), so as to exclude all air. If this is not done, the bacteria and fugus spores may enter and possibly cause certain rots or decay of the wood tissue at this point. If possible to secure scions and stocks it might be well to have each pupil graft or bud a tree and set it out on the school grounds.

Suggestions: Why is it important in grafting. that the cambium layers of scion and stock be brought together? What do you understand by the word stock? By scion? Compare the efficiency of these two methods of grafting and budding as a means of propagation.

APRIL: THIRD WEEK

TOPIC: SOIL STUDY—Physical Properties. (Text, pp. 1-18.)

References: 50; 74; 86; 123; 127-A; 240; 249.

Suggestions: If these laboratory exercises can be performed outside of the regular agricultural period, this time can be given over to a class discussion of the topic being demonstrated.

Exercise No. 58:

Purpose: To study the soils of home fields or garden.

Materials: A rule or yard stick, spade, three ½ pt. fruit jars, scales or balances registering ½ ounce or grammes.

Procedure: Select a spot in the field or garden which is uniform with the balance of the field. Fill jar No. 1 with earth taken at a depth of six inches; No. 2 with earth taken at a depth of 12 inches, and No. 3 at a depth of 24 inches. Place the samples in the schoolroom, keeping each pupil's collection together. Have the pupils note all the differences which may be apparent in the samples taken at different depths and in different fields. If scales or balances are available, have 10 ounce or 100 gramme air-dry samples of soil taken from each jar and placed in a metal pan or shovel and burned until the soil is red hot or has quit smoking. Weigh each sample of burned soil and record the weight. The difference represents the amount (plus a very small amount of water) of organic matter or humus contained in the soil. Have the children record on each jar of soil, in terms of per cent, the approximate amount of humus contained in the soil.

Application: The depth and the nature of the soil and subsoil on any farm is very important, likewise the amount of humus contained in the soil. Pupils should be encouraged to study the soils of their home farm and garden.

Exercise No. 59:

Purpose: To study the physical composition of soils.

Materials: Samples (one or two quarts) of coarse sand; silt, (obtained from creek beds) and clay, 3 one-quart fruit jars; a quart pan.

Procedure: (a) Examine with the fingers, the three samples of soil. Note the difference in size, shape feeling and color of the soil particles. (b) Place equal amounts of sand, silt and clay (enough to fill the jar one-fourth full) in a fruit jar and fill with water. Fasten down the cover and shake the jar for one minute. Allow contents to settle. Note the separation of soil particles that occurs. (c) Have the students bring samples of soil from the home field and make a "water analysis" as in (b). Does sand, silt or clay predominate in their soils? (d) Place a small sample of ordinary soil in a jar, fill with water, fasten on the cover and shake. Allow the contents to settle for one hour and then strain the muddy top water through muslin into a shallow pan, to get rid of any coarse organic matter, and place in a warm sunny place to evaporate. When the water has evaporated and the residue is dry, rub a sample between the thumb and fingers. This residue is nearly pure clay.

Application: All agricultural soils are composed of more or less finely ground rock (gravel, sand, silt and clay) and decomposed organic matter (humus). The kind of crops to be grown and the kind of implements to be used depends largely upon the physical composition of the soil. Encourage the students to examine both the surface and subsoil of their home fields and bring samples to school.

EXERCISE No. 60:

Purpose: To study percolation, or how water moves downward in soils.

Materials: Four student-lamp chimneys; cheese cloth; saucers.

Procedure: (a) Tie pieces of cheese cloth over the small ends of four lamp chimneys and label them 1, 2, 3 and 4 respectively. Fill No. 1 to within one inch of the top with fine gravel; No. 2 with fine sand; No. 3 with clay, and No. 4 with soil from garden or field. Elevate the chimneys on two blocks of wood in a pan or saucer so that drainage is possible. Fill the space in the upper ends of the chimneys with water and keep filled until drainage begins in each. Note the relative rapidity with which the water sinks or percolates in each type of soil.

Application: Rain, snow or irrigation water gets into the soil by percolation, that is it sinks in response to the pull of gravity. Water percolates faster in some soils than in others. That is why one farmer can begin plowing immediately after a rain while another may have to wait a week.

EXERCISE No. 61:

Purpose: To study film water, or how water is held in a soil.

Material: Five empty tomato cans, a liquid measure, fine sand, clay, humus and garden loam.

Procedure: (a) Punch holes in the bottoms of the tomato cans. Fill each with sand, clay, humus, and garden loam respectively, placing equal amounts by volume in each. Place the cans over saucers so that the drainage water from each can be caught and measured. Using a liquid measure, pour a given amount of water into each can. When drainage ceases, measure the water that comes through and subtract this amount from the amount poured in. Record the result in terms of per cent. (b) Fill one tomato can with pure dry sand, fill another with equal amounts of dry sand and humus, mixed. Pour a given amount of water into each can, catch and measure the drainage water and record the results. Does the addition of humus increase or decrease the water-holding capacity of the soil? (c) Dip a dry pebble or rock into water and then hold in the air. Observe how a thin film of water resisting the pull of gravity completely envelopes the object. Every tiny soil particle in the soil is enveloped with a film of water in a like manner.

Application: Film moisture is of the greatest agricultural importance, as it is from this that growing plants obtain their whole supply of moisture and all the food that is taken from the soil by the roots. The feeding ground of the crop is measured by the sum of the surface areas of the soil particles that make up that portion of the soil occupied by the plants' roots.

Soils vary greatly in the amount of water retained, the variation being influenced by the size of the soil particles. This fact can be demonstrated both physically and mathematically. If we fill a chalk box with marbles, each time the diameter of the marbles is divided by two, the surface area of the spheres in the box is multiplied by two. While the soil particles are not perfect spheres the same mathematical principle holds true. King in "The Soil," page 72, states that the total surface area of the soil grains in a cubic foot of sandy soil is about one acre, while the area of the particles in a clay soil is nearly four acres.

EXERCISE No. 62:

Purpose: To study capillarity or how water moves in the soil.

Material: Four lamp chimneys, cheese cloth, saucers, sand, silt, clay and garden soil.

Procedure: Tie a piece of cheese cloth around the bottom of each lamp chimney. Fill the lamp chimney with sand, silt, clay and garden loam, respectively, and place in the saucers. Fill saucers with water until the bases of the chimneys are one inch below the surface. Note the upward movement of water in the columns of soil. In which soil does the water move most rapidly at first? In which soil is it the highest at the end of five hours? One day?

Application: Water moves upward in the soil in response to the same natural law that causes oil to move upward in a wick. This is called capillarity. The capillary movement of water in the soil is of utmost importance in crop production for as fast as the film of water enveloping the soil particles in the upper layers of the soil are evaporated by the sun or wind, or withdrawn by the roots of plants, a new supply is drawn upward from the depths below to take its place. There is a limit to this upward pull, however, which varies with the character of the soil and the heights of the water table or ground water level. Capillarity is strongest and most rapid in a fine or firm soil. That is why the column of water is highest in the clay column and why a soil with a hard, compact surface dries out more quickly than a soil with a loose surface or mulch.

APRIL: FOURTH WEEK

TOPIC: SOIL STUDIES—Chemical Properties. (Text, pp. 18-26.)

References: 7; 19; 21; 50; 51; 74; 87; 90; 121; 123; 138; 200; 240.

Suggestions: These exercises should be set up outside of the regular agricultural recitation period. Most students will welcome the opportunity to do this additional work. The regular period can then be devoted to a class discussion of the principles involved in the exercise and their practical application.

Lesson Topics: Each of the exercises given below may be made the subject of a lesson.

Exercise No. 63:

Purpose: To learn how to determine the plant food requirements of a soil.

Material: A strip of ground in the school garden; liberal samples of the various commercial fertilizers, such as lime, nitrate of soda, super-phosphate and potash.

Procedure: Divide the plot of ground into 12 plats, each 4 by 4 feet square or, if plenty of land is available, 4 by 8 feet in size, leaving a path or border 2 feet wide between the plats. Label these plats 1 to 12, respectively. Do not add fertilizer of any kind to plats Nos. 1, 6 and 12. These are to serve as checks on the others, (an experiment of any kind will be worthless without a check or control of some kind). Apply nitrogen to Plat 2 in the form of nitrate of soda, at the rate of 2 pounds per square rod. Apply phosphorus to Plat 3 in the form of acid phosphate at the rate of 4 pounds per square rod. Apply potash to Plat 4 in the form of muriate of potash at the rate of 2 pounds per square rod. To Plat 5 apply 4 pounds of air-slaked lime. To Plat 7 apply both nitrogen and potash at the rates given above. To Plat 8 apply both phosphorus and potash at the rates given above. To Plat 9 apply nitrogen and phosphorus at the rates given above. To Plat 10 apply nitrogen, phosphorus and potassium at the rates given above. To Plat 11 apply one wheelbarrow load of well-rotted barnyard manure. Spade each plat to a depth of 6 or 8 inches, thoroughly mixing the fertilizer with the soil in so doing. Several different garden and field plants should now be planted in rows running clear across the 12 plats. Plant oats, wheat or barley or alfalfa and clover in rows 4 inches apart. Radishes, lettuce and beets, etc., should be planted in rows 12 to 18 inches apart. Potatoes and corn in rows 30 inches apart. Cultivate the plants in all of these plats the same day and in the same manner. If irrigation is necessary, each plat should receive the same amount of water. Note carefully the rate of growth, vigor and color of the plants in each of the plats.

Explanation: This exercise will require considerable time and effort but will be well worth while because of the interest it arouses. Every farmer by this method can determine the fertilizer requirements of his own soil better than any chemist can by laboratory analysis of his soil.

Exercise No. 64:

Purpose: To learn how to determine whether a soil is acid or alkaline. Also, to note the effects of soil acidity upon plant growth.

Material: Some red and blue litmus paper, dilute sulphuric acid or vinegar.

Procedure: (a) Place a drop of vinegar or acid upon a piece of blue litmus paper. Note the change in color. (b) Place a drop of a solution of sodium bi-carbonate on a piece of red litmus paper and note the change in color. (c) Place a strip of red litmus paper and another of blue litmus between moistened layers of earth obtained from the field or garden. Note any decided change in color of the litmus paper. Remember that acids turn the blue litmus red and alkalines turn red litmus blue. (d) If a soil is suspected of being acid, (if it is low and wet and contains much organic matter or will not grow clover or alfalfa) bury a strip of blue litmus paper to a depth of three or four inches in moist earth and leave for several hours. At the end of this time remove from the soil and see if there has been any decided change in color. (If acid soils are not available, the teacher may prepare some by mixing vinegar or a dilute solution of sulphuric or hydrochloric acid, with a pint of soil and then have the pupils test this.) (e) Take a sample of about a quart of the natural soil, or that prepared by the teacher, and mix with it a handful of air-slaked lime. Test with red and blue litmus paper both before and after the application of lime. (f) Fill two cans provided with drainage holes, with garden soil and plant alfalfa and wheat in each. Water both cans with pure water until the plants are three or four inches high. Continue to water one can with pure water but water the other with a very weak solution of vinegar, or sulphuric acid. Apply the same amount of liquid to each can at each irrigation. Note any change in the color of foliage and vigor of growth. Record such changes from day to day. At the end of six weeks examine the roots of the plants in each can and note the results.

Application: Many otherwise good agricultural soils will not produce full crops because their acidity inhibits plant growth. The litmus test is an easy and fairly accurate method of determining such acid soils and costs but very little. The remedy for an acid soil is to treat with an application of lime.

Exercise No. 65:

Purpose: To demonstrate how some alkaline soils are found. Also, how alkali injures plants.

Material: Three large tomato cans, two provided with drainage holes, one without; ½ pint of sodium carbonate (common baking soda) or sodium chloride (common salt).

Procedure: (a) Thoroughly mix ½ pint of sodium carbonate or sodium chloride with the quart of ordinary garden soil. Place in one tomato can without any drainage holes and thoroughly soak. As the water evaporates look for a whitish deposit on the surface. (Note: In alkali regions you can easily obtain samples of the natural alkali for use in this experiment.) (b) Fill two cans provided with drainage holes with good garden soil. Plant some wheat, or barley grains in each. After the plants are three or four inches high, place one can in a saucer containing a strong solution of sodium carbonate or salt so that the solution will be drawn up through the column of soil by capillary action. Take the other can and set it in a saucer containing only pure water. Test the soils in both cans from day to day with red litmus paper. Make note of any decided change in the color of the plants.

Application: Nearly all soils in arid regions contain more or less of the soluble salts called alkali (in humid regions such salts have been leached out by the heavy rains.) In many arid soils the alkali salts do not appear on the surface until irrigation water is applied. If only a slight amount of water is applied the water percolates to a depth of four or five feet and as it rises again through capillarity it carries to the surface and concentrates or deposits there by evaporation the alkali that has been contained in the depths of the soil. Still other soils, containing but little alkali, have been rendered unproductive because the use of irrigation water on higher adjacent lands have leached out the alkali they contained and the drainage or seepage water has carried it to the lower lands. Such gravitational water, heavily charged with the alkali salts, is drawn to the surface by capillarity and by evaporation has deposited the alkali it contains in solution on the surface. Hundreds of acres of otherwise good soils have been rendered unproductive in this manner.

MAY: First Week

Topic: Soil Studies—Tillage; Drainage; Irrigation.

References: 35; 41; 86; 98; 118-A; 120; 121; 160; 246; 248; 301; 327; 339; 350; 354, 356; 359; 366; 375; 377; 381; 383; 384.

Suggestions: The exercises outlined for this week, like those of the two preceding weeks, have practical bearing upon gardening and the field culture of crops.

Lesson Topics: By having the exercise below performed out of class hours, the agricultural period can be utilized for discussing the practical application of the principle being demonstrated.

Exercise No. 66:

Purpose: To demonstrate the conservation of soil moisture by assisting or checking percolation.

Materials: A strip of land of the school yard, a sprinkling pan and two empty coal oil cans, provided with drainage holes.

Procedure: (a) Mark off a strip of ground (one having a gentle slope if possible), 4 feet wide and 16 feet long. Divide the strip into 3 plats each 4 feet square, leaving a path 2 feet wide between the plats. Label these plats A, B and C respectively. Leave the surface of Plat A hard and firm. Cultivate the surface of Plat B to a depth of 3 inches and spade Plat C to a depth of 12 inches. Using a sprinkling pan, or similar device, apply equal amounts of water (five gallons), to the surface of each plat, using the same amount of water on each plat. Dig into each plat five or six hours after the water has been applied and note the depth to which the water has penetrated. (b) Fill one coal oil can with dry sand, fill another with equal parts of dry sand and well-rotted, dry manure. Pour a measured amount of water into each can. Catch the drainage water from each and note the relative amount of water retained by each.

Application: In semi-arid regions the farmers have to conserve every inch of rainfall. They do this by making it easy for the rainfall to percolate into the soil, and difficult for it to escape, once it gets into the soil. Exercise (a) demonstrates a fundamental principle of dry farming. In light and sandy soils, percolation is rapid. Farmers cultivating such soils can increase the water-holding capacity by the addition of humus such as straw, barnyard manure, etc. Exercise (b) illustrates this.

EXERCISE NO. 67:

Procedure: To demonstrate the conservation of soil moisture by checking capillarity.

Material: Four lamp chimneys, cheese cloth for tying on bottoms of chimneys; four coal oil cans with tops removed.

Procedure: (a) Fill the four lamp chimneys with soil taken from the field or garden, compacting the soil as much as possible in each; label these 1, 2, 3 and 4 respectively. Remove the upper three inches of soil in No. 1 and put in a layer of finely chopped straw to a depth of one-half inch, and then fill up with soil. cultivate the surface of No. 2 to a depth of three inches and keep in a very loose condition. Remove two inches of soil in No. 3, and replace with a layer of straw. Leave the surface of No. 4 compact. Place each chimney in a snug-fitting can of water. Place a collar of cardboard around each chimney and over the top of the vessel to prevent direct evaporation of water. Place equal amounts of water in each vessel. Note the relative rapidity with which the water is evaporated by each column of soil. (b) Fill three coal oil cans with ordinary dry soil. Wet each can of soil until drainage begins. Weigh and record weight of each. Cultivate the surface of can No. 1 to a depth of three inches and keep in a fine loose condition. Cover the surface of can No. 2 with a three-inch mulch of straw. Leave the surface of the soil in can No. 3 hard and compact. Weigh the cans from day to day and note the relative rapidity with which the moisture is evaporated. (c) Mark off a strip of land in the school yard or other convenient place, four feet wide and 16 feet long. Divide this strip into three plats each four feet square, separated by strips two feet wide. Label the plats A, B and C respectively. Leave the surface of Plat A hard and uncultivated but keep the weeds down by shaving off with a sharp hoe at the surface of the ground. Spade Plat B to a depth of eight inches and cultivate after each rain with a rake to a depth of three inches. Spade Plat C to a depth of eight inches and cover with a three-inch mulch of straw or grass. After a dry spell of a week or so, have the students dig a hole in each plat and note the comparative dryness of each soil.

Application: The importance of the conservation of soil moisture in semi-arid regions, and even in Western Oregon, during a period of drouth, cannot be too strongly emphasized. More "horse-leg" irrigation is needed on every farm.

EXERCISE No. 68:

Purpose: To study the properties of gravitational water or ground water.

Material: A quart of clean gravel, five one-half pint fruit jars, a liquid measure.

Procedure: Sort or sift the quart of gravel into large, medium and small sized particles. Fill the three jars with the large, medium and small sized particles respectively. Fill a fourth with sand, and a fifth with clay. Have equal amounts of gravel by volume in each jar. Using the liquid measure, pour just enough water into each jar to bring the water up to a level with the surface of the gravel particles in each. Note the amount of water contained in each soil. Which soil contains or holds the most water? (This can be demonstrated by using marbles, buck shot and BB shot, instead of gravel.)

Application: The soil is said to be saturated with water when the air spaces between the soil particles are filled with water. Such soils are called wet, and must be drained before crops can be grown. The water that fills the soil spaces is called gravitational or ground water because it moves in response to the pull of gravity.

EXERCISE No. 69:

Purpose: To study the influence of drainage upon plant growth.

Materials: Four large tomato cans or five-pound pails, three being provided with drainage holes.

Procedure: (a) Fill two cans (one without drainage holes) with garden soil and plant 10 wheat or barley grains in each. Apply the same amount of water to each can twice a week (one-half cupful each time). Note any difference in the time of germination and the vigor of the seedlings. (b) Fill two cans provided with drainage holes, with garden soil and plant 10 wheat grains in each. Water twice a week. When the seedlings are two to four inches high, seal the bottom of one can by dipping in melted wax or paraffin, leaving the outlets in the other open. Continue to water as before, giving each can the same amount of water at each application. Note any change that occurs in the color and vigor of the plants in each can.

Application: Many otherwise good agricultural soils are producing poor crops because percolation is hindered by a hardpan, or impervious layer of clay, and artificial drainage becomes necessary.

MAY: Second Week

Topic: Plant Study—Reproduction; Seed Formation. (Text, pp. 44-53.)

Other References: 123; 204.

Suggestions: How are seeds formed? Why do some flowers produce fruit while others do not? What is the significance of the structure of some flowers? These are just a few of the many thought-stimulating questions a study of the flower will develop.

Lesson Topics: (a) The parts of a flower: the use of each part. (b) The meaning of "self-pollination" and "cross-pollination"; "pistillate" and "staminite" blossoms; "monoecious" and "dioecious" flowers. Cite examples of each. (c) Relation of insects to pollination. Significance of the odor, color and nectar in flowers. (d) Hybridizing: methods.

Exercise No. 70:

Purpose: To study a few simple flowers so as to know the arrangement and structure of the different parts.

Material: Flowers of apple, cherry, tomato, petunia or any ordinary complete flower may be used.

Procedure: Study the flower which may be available and make a drawing of it. Locate the points where the flowers arise from the stem. Is there anything else growing from this same place? What? Are there any exceptions? Study a side view of the flower; then examine it as to parts. The lower, outer set of parts is the *calyx*, made up of green leaf-like components called *sepals*. Inside the *calyx* is the *corolla*, which is made up of petals. The *calyx* and *corolla* together are called the *perianth*. Inside the *corolla* are the *stamens*, each consisting of a slender stalk or filament with a knob on the end, called the *anther*. Inside of the circle of *stamens* is the *pistil*. This consists of three parts: the top or *stigma;* below this a long, column-like neck, the *style;* below the *style* comes the swollen bulbous base, the *ovary*. Label all the parts in the drawing you have made, then split the flower lengthwise with a knife and study the parts within. Pull off one *sepal* and make a sketch. Make sketch of a *stamen;* a *petal;* the *pistil*, labeling all parts fully.

Suggestions: Ask yourself the following questions: How many *sets* and *parts* are there in a flower, and in what order do they occur? Are the *petals* of the *corolla* joined together? How many *petals* are there? Name all the parts of a flower beginning at the base. Name and locate the parts of a *stamen*. Name and locate the parts of a *pistil*.

EXERCISE No. 71:

Purpose: To learn how to emasculate and cross-pollinate flowers.

Material: Whatever plant is to be used (the flower of the apple, tomato, squash, corn, etc.), a fine pointed scissors, a few bags, string and cardboard labels. (Note: Always write labels with lead pencil when these are exposed to the weather; ink would blur upon becoming wet.)

Procedure: Select as many flowers of one kind as are to be used. Carefully remove the *stamens* by means of the sharp-pointed scissors, before any of the fine *pollen* which develops on them has commenced to be shed. Tie a paper sack over each flower so as to prevent any *pollen* from getting in. Examine other blossoms to ascertain just about what time the *pollen* is being shed. The *pistil* will now be ready to receive the *pollen* on its upper end, the *stigma*. Collect some *pollen* from other flowers of the same kind of plant. It may be collected by simply shaking it off into an envelope or other receptacle. In the cases of those flowers where the *pollen* is sticky it is well to remove it with a fine camel's hair brush. Place this *pollen* on the *stigma* of the flowers which you have previously covered with paper sacks. Tie each flower up again to prevent the entrance of foreign *pollen*. The fruit develops from the *pistil*, particularly the ovary of the *pistil*. This part contains the seed, and none of the seeds will mature unless a certain number of *pollen* grains fall on the *stigma*, one for each seed. It is important, therefore, that pollination take place.

Suggestions: Define "pollination"; "fertilization." Of what use is cross-pollination in the producing of new strains of plants?

MAY: THIRD WEEK

TOPIC: INSECT PESTS OF HOUSE AND GARDEN—(Text, pp. 118-147.)

Other References: 31; 38; 137; 142; 166; 166-B; 168-A; 200; 204; 210; 228; 390.

Suggestions: Students should become familiar with the life history or various stages in the development of some of the common insects.

Lesson Topics: (a) The life history of the house-fly. (b) The life history of the mosquito. (c) The life history, habits and control of biting and chewing insects (cabbage worm, radish maggot, etc.) injurious to garden crops. (d) The life history, habits and control of sucking insects (scale insects, plant lice, etc.), injurious to garden crops.

Exercise No. 72:

Purpose: To study the development of the blow-fly.

Materials: A piece of fresh meat; a can or bucket partly filled with moist earth.

Procedure: Expose the meat in the open air for an hour or so (until the large blowflies have been observed hovering about it). Observe the meat closely and see if the small white eggs of the fly can be detected. Place the meat in the pail of moist earth, screen and put in a warm place. Watch the meat daily for the little maggots, or *larvae* of the fly. Note how long it takes the eggs to hatch; the larvae to *pupate;* the *pupa* to develop into the adult fly.

Exercise No 73:

Purpose: To study the development of the mosquito.

Materials: A tub, barrel, can or bucket of water left in an exposed place. (There should be water enough so the contents will not quickly evaporate.)

Procedure: The surface of the water should be closely watched for the dark-brown boat-shaped masses of mosquito eggs which look like bits of floating soot. These eggs will hatch in from one to seven days and the *larvae* or wrigglers will appear. Note the feeding and other habits of the *larvae.* After a week or 10 days, begin watching for the *pupa* which differ from wriggler in that the head part is much enlarged. The *pupae* lie quietly near the surface when not disturbed. After spending four or five days in the *pupal* condition the skin breaks along the back of the *pupa* and the full-grown mosquito crawls out, dries its wings and flies away in search of some animal for its meal of blood. After the wrigglers become abundant in the large vessel, dip out some in a can or bucket. Pour a few drops of coal oil into the water. Note how the oil behaves. Also, see what happens to the wrigglers.

MAY: Fourth Week

Topic: Beneficial Insects—(Text, pp. 207-211.)

Other References: 118; 138-A; 152; 200; 336; 386.

Suggestions: Every school in the State should own a hive of bees. The hive should be made with one side of glass so that the habits of these interesting insects can be observed.

Lesson Topics: (a) The life history of the honey bee. (b) The care and management of bees. (c) Study of some predaceous insects; habits; life history. (d) Significance of insect parasitism and its relation to the control of crop pests.

EXERCISE No. 74:

Purpose: To study the honey bee: the worker.

Material: A few dead workers which may be found around any hive.

Observations: 1. How many divisions of the body are there? 2. What organs are borne on the head? 3. Are these small simple eyes between the large compound ones? 4. What is the difference between the large eyes and the small? 5. Describe the *antennae*. 6. What can you see of the mouth? Describe it. 7. Look at the tongue under the lens and see how it is fitted for getting nectar from flowers. 8. What organs are borne on the thorax? 9. Study the front or middle leg. How many joints has it? 10. With the lens find the *antennae* cleaner on the front leg. Describe it. 11. Describe the feet and claws. 12. Compare the third segment of the hind leg with that of the front leg. 13. Note that this segment of the hind leg is much wider. Note its form and describe how it forms the *pollen* basket. 14. Study the second joint of the hind leg, and note the wax pincers and the *pollen* combs. 15. Compare the front and hind wing as to shape and size. 16. How many rings are there on the abdomen and how are the rings colored above? 17. Study the lower side of the body; do you know where the wax comes from? (This and the two following exercises were taken from Cornell Home Nature Study Course, Vol. V., No. 3.)

EXERCISE No. 75:

Purpose: To study the honey bee; the queen and the drone.

Material: A queen bee and some drones, either alive or dead, but preferably a live queen in a queen cage with her attendants; and some live drones.

Observations: 1. How does the queen differ in size and shape from the worker? 2. Has she *pollen* baskets or *pollen* combs on her hind legs? 3. How does the shape of the abdomen differ from that of the worker? 4. How does the drone differ in size and form of body from the worker? 5. How does he differ in these respects from the queen? 6. Has he *pollen* baskets on his legs? 7. Has he a sting? 8. Compare his eyes with those of the queen and the worker. 9. Compare the size of his wings with those of the queen and worker.

EXERCISE No. 76:

Purpose: To study the honey comb.

Material: A section filled with honey and also a bit of empty comb and a bit of commercial foundation comb which may be obtained in any apiary.

Observations: 1. Look at a bit of empty honey comb; what is the shape of the cell as you look down into it? 2. What is the shape of the bottom of the cell? 3. How does the bottom of the cell join the bottom of the cell opposite? Explain how honey comb economizes space as storage for the honey, and why an economy of space is of use to the bees in the wild state. 4. In the hive, is the honey comb placed so that the length of the cells are horizontal or up and down? 5. Observe honey comb containing honey; how is the honey retained in the cells? 6. Carefully take off a cap from the honey cell and see if you can find the six girders that extend inward from the angles of the cell to support the circular portion in the center. 7. By what means is the honey comb made fast to the sides of the section or the hive? 8. Study a bit of foundation comb and note where the bees will pull out the wax to form the cell. 9. Why and how is foundation comb used by the bee keeper? 10. For what purpose besides storing honey are the cells of honey comb used by the bees?

JUNE: FIRST WEEK

TOPIC: BENEFICIAL ANIMALS—Birds, Bats, Toads, etc. (Text, pp.234-240.)

Other References: 32; 54; 141; 148; 150-A; 154; 157; 179; 182; 200; 305; 306; 314; 319; 322; 329; 333; 345; 368; 376; 388; 396.

Suggestions: Many of the animals looked upon as pests are really friends in disguise, and once their economic importance is understood, men take measures to protect them. The discussion this week should center around those types which are common in the community, special emphasis being placed upon their habits. The pupils should get as much of their information as possible by actual observation of the animal. The references given will prove helpful.

Lesson Topics: (a) The resident and migratory birds common in the locality; their feeding and nesting habits. (b) The insectivorous and seed-eating birds common in the locality. (c) The economic importance of birds. (d) The food, habits, and importance of frogs and toads. (e) The food, habits, and importance of snakes, bats, etc.

JUNE: Second Week

Topic: The Agricultural Resources of Oregon.

References: 143-B; 200; 202; 204; 246; 248; 318; 330.

Lesson Topics: (a) The types of farming practiced in the community and county. Average yields and profits. (b) The great natural divisions of the State and the types of farming practiced in each. (c) The fruit (grain, hay, livestock, etc.) sections of the State; varieties grown; amount produced; value of product. (d) When and how the various farm products are marketed. Opportunities along agricultural lines that await skilled hands and trained minds.

Exercise No. 77:

Purpose: To make an intensive study of agriculture in Oregon.

Suggestions: The school should be provided with one or more copies of reference No. 202. The advertising bulletins published by the commercial clubs throughout the State and especially those pertaining to the county should be available.

Procedure: Each student should make an outline map of Oregon and indicate thereon the great natural agricultural divisions of the State. The products of the various divisions should be listed within the outline of each, and if the map is made large enough, the principal fruits, field crops, livestock and forest trees can be written within the outline of each county. This map of Oregon should form a basis for the discussion of the various lesson topics.

REFERENCE BIBLIOGRAPHY

Nearly all of the books and bulletins mentioned in the following list can be obtained free. They should be procured as fast as needed and properly filed in the school library.

FARMERS' BULLETINS

United States Department of Agriculture, Washington, D. C.
Division of Publications

(Note: When asking for bulletins, always give the *Bulletin number* and *title;* never mention the key number.) Farmers' Bulletins not obtainable through the Division of Publications can usually be secured from the Superintendent of Documents, Washington, D. C., for 5 cents a copy.

Key No.	Bull. No.	
1	22	The Feeding of Farm Animals.
5	35	Potato Culture.
7	44	Commercial Fertilizers.
8	49	Sheep Feeding.
9	51	Standard Varieties of Chickens.
10	54	Some Common Birds.
11	55	The Dairy Herd.
13	61	Asparagus Culture.
14	62	Marketing Farm Produce.
16	64	Ducks and Geese.
19	77	The Liming of Soils.
21	88	Alkali Lands.
22	91	Potato Diseases and Treatment.
22-A	96	Raising Sheep for Mutton.
23	99	Insect Enemies of Shade Trees.
24	106	Breeds of Dairy Cattle.
25	113	The Apple and How to Grow It.
27	126	Practical Suggestions for Farm Buildings.
28	127	Important Insecticides.
29	128	Eggs and Their Uses as Food.
30	131	Household Tests for Detection of Oleomargarine and Renovated Butter.
31	132	Insect Enemies of Growing Wheat.
32	133	Birds as Wheat Destroyers.
33	134	Tree Planting in Rural School Grounds.
34	137	The Angora Goat.
35	138	Irrigation in Field and Garden.
36	142	Principles of Nutrition and Nutritive Value of Food.
37	154	The Home Fruit Garden; Preparation and Care.
38	155	How Insects Affect Health in Rural Districts.
39	156	The Home Vineyard.
40	157	The Propagation of Plants.
41	158	How to Build Small Irrigation Ditches.
42	166	Cheesemaking on the Farm.
43	170	Principles of Horse Feeding.
44	173	Primer of Forestry.
44-A	175	Home Manufacture of Grape Juice.
45	177	Squab Raising.
46	181	Pruning.

Key No.	Bull. No.	
47	182	Poultry as Food.
48	183	Meat on the Farm: Butchering, Curing and Keeping.
49	185	Beautifying the Home Grounds.
51	192	Barnyard Manure.
52	194	Alfalfa Seed.
53	195	Annual Flowering Plants.
54	196	Usefulness of the American Toad.
55	198	Strawberries.
57	200	Turkeys.
58	203	Canned Fruits. Preserves and Jellies.
59	205	Pig Management.
61	210	Wheat Culture.
62	213	Raspberries.
64	218	The School Garden.
65	220	Tomatoes. Epidemic of 1904.
66	224	Canadian Field Peas.
67	228	Forest Planting and Farm Management.
68	229	The Production of Good Seed Corn.
69	236	Incubation and Incubators.
70	237	Running Out of Seed Wheat.
71	241	Butter-Making on the Farm.
72	242	An Example of Model Farming.
73	243	Fungicides and Their Use in Preventing Diseases of Fruits.
74	245	Renovation of Worn-out Soils.
75	248	The Lawn.
76	250	Prevention of Wheat Smut and Loose Smut of Oats.
77	252	An Example of Model Farming.
78	253	The Germination of Seed Corn.
79	254	Cucumbers.
80	255	The Home Vegetable Garden.
81	256	Preparation of Vegetables for the Table.
82	257	Soil Fertility.
83	260	Seed of Red Clover and Its Impurities.
84	262	Glutinous and Starchy Wheats.
85	263	Practical Information for Beginners in Irrigation.
86	266	Management of Soils to Conserve Moisture.
87	270	Modern Conveniences for the Farm Home.
88	271	Forage Crop Practices in Western Oregon and Western Washington.
89	272	A Successful Hog and Seed-Corn Farm.
90	278	Leguminous Crop for Green Manuring.
91	280	A Profitable Tenant Dairy Farm.
92	282	Celery.
93	287	Poultry Management.
94	289	Beans.
95	291	Evaporation of Apples.
96	292	Cost of Filling Silos.
97	293	Use of Fruit as Food.
98	294	Farm Practice in the Columbia Basin Uplands.
99	295	Potatoes and Other Root Crops as Food.

Key No.	Bull. No.	
100	298	The Food Value of Corn and Corn Products.
101	303	Corn Harvesting Machinery.
102	306	Dodder in Relation to Farm Seeds.
103	313	Harvesting and Storing Corn.
104	315	Progress in Legume Innoculation.
105	320	Quality in Wheat.
106	321	The Use of the Split-Log Drag on Earth Roads.
106-A	324	Sweet Potatoes.
107	327	The Conservation of Natural Resources.
109	339	Alfalfa.
110	342	Potato Breeding.
110-A	345	Some Common Disinfectants.
110-B	347	Repair of Farm Equipment.
111	346	Computation of Rations for Farm Animals.
111-A	347	Repair of Farm Equipment.
112	353	Commercial Clover Seed.
113	354	Onion Culture.
114	355	A Successful Poultry and Dairy Farm.
114-A	358	Primer of Forestry, part 2.
114-B	359	Canning Vegetables in the Home.
114-C	363	Use of Milk as Food.
114-D	365	Farm Management in Potato Sections.
115	368	The Eradication of Bind Weed or Wild Morning Glory.
116	370	Replanning a Farm for Profit.
116-A	371	Drainage of Irrigated Lands.
116-B	373	Irrigation of Alfalfa.
116-C	375	Care of Food in Home.
116-D	379	Hog Cholera.
116-E	382	Adulteration of Forage Plant Seeds.
116-F	385	Boys' and Girls' Agricultural Clubs.
117	386	Potato Culture on Irrigated Farms.
117-A	387	Preservative Treatment of Farm Timbers.
117-B	395	Sixty-day and Kherson Oats.
118	397	Bees.
118-A	399	Irrigation of Grain.
118-B	400	Most Profitable Corn Planting Method.
119	401	Frost Fighting in the Pacific Northwest.
119-A	403	Construction of Concrete Fence Posts.
120	404	Irrigation of Orchards.
121	406	Soil Conservation.
122	407	Potatoes as a Truck Crop.
123	408	School Exercises in Plant Production.
124	409	School Exercises in Corn.
125	413	Care of Milk in the Home.
126	415	Seed Corn.
127	420	Oats: Distribution and Use.
127-A	421	Control of Blowing Soils.
128	423	Forest Nurseries for Schools.
129	424	Oats: Growing the Crop.
130	426	Canning Peaches on the Farm.
131	428	Testing Seeds in the Home and at School.

Key No.	Bull. No.	
132	432	How a City Family Managed a Farm.
133	433	Cabbage.
134	434	Home Production of Onion Sets.
134-A	437	System of Tenant Farming and Its Results.
135	438	Hog Houses.
136	443	Barley: Growing the Crop.
137	444	Remedies and Preventives Against Mosquitos.
137-A	445	Marketing Eggs Through Creameries.
138	446	Choice of Crops for Alkali Lands.
138-A	447	Bees.
139	451	Clover Growing.
139-A	452	Capons.
140	455	Red Clover.
140-A	454	Successful New York Farm.
141	456	The Grosbeaks: Their Value to Agriculture.
142	459	House Flies.
143	460	Frames as a Factor in Truck Farming.
143-A	461	Use of Concrete on the Farm.
143-B	462	Utilization of Logged-off Land.
143-C	463	Sanitary Privy.
144	468	Forestry in Nature Study.
145	471	Grape Propagation, Pruning and Training.
145-A	473	Tuberculosis.
145-B	474	Use of Paint on Farm.
145-C	475	Ice Houses.
145-D	478	How to Prevent Typhoid Fever.
145-E	480	Practical Methods of Disinfecting Stables.
145-F	481	Concrete Construction on Livestock Farm.
146	482	The Pear and How to Grow It.
146-A	485	Sweet Clover.
146-B	488	Diseases of Cabbage.
146-C	490	Bacteria in Milk.
146-D	491	Profitable Management of Small Apple Orchard.
147	492	Insect and Fungous Enemies of the Apple.
148	493	English Sparrows as Pests.
148-A	494	Lawn Soils and Lawns.
149	495	Alfalfa: Seed Production.
150	496	Raising Belgium Hares.
150-A	497	Some Common Game in Relation to Man.
151	502	Timothy Production on Irrigated Lands of Pacific Northwest.
152	503	Comb Honey.
153	505	Benefits of Public Roads.
154	506	Foods of Some Well Known Birds.
155	507	Smuts of Grain.
156	511	Farm Bookkeeping.
157	513	Fifty Common Birds of Farm and Orchard.
158	515	Vetches.
158-A	518	Winter Barley.
159	521	Canning Tomatoes at Home and as Club Work.
160	524	The Drainage of the Farm.

Key No.	Bull. No.	
161	525	Raising Guinea Pigs.
162	528	Hints to Poultry Raisers.
163	530	Important Poultry Diseases.
163-A	531	Larkspur, or Poison Weed.
164	533	Good Seed Potatoes: How to Produce Them.
164-A	534	Durum Wheat.
165	537	How to Grow an Acre of Corn.
166	540	The Stable Fly.
166-A	541	Farm Butter Making.
166-B	543	Common White Grubs.
167	544	Potato Tuber Diseases.
168	545	Control of Canada Thistles.
168-A	547	Yellow Fever Mosquito.
169	553	Pop Corn for the Home.
170	554	Pop Corn for the Market.
170-A	556	Making and Feeding of Silage.
171	557	The Potato Tuber Moth.
172	561	Bean Growing in Eastern Oregon and Washington.
173	562	Boys' and Girls' Poultry Club.
174	556	Boys' Pig Club.
174-A	572	System of Farm Cost Accounting.
175	573	The Angora Goat.
176	574	Poultry House Construction.
177	576	Breeds of Sheep for the Farm.
178	578	Making and Feeding Silage.
179	583	The Common Mole.
180	585	Natural and Artificial Incubation.
181	586	Collection and Preservation of Plant Materials, for Study of Agriculture.
182	587	Economic Value of the Skunk.
183	594	Shipping Eggs by Parcel Post.
184	599	Pasture and Grain Crops for Hogs in the Pacific Northwest.
185	597	The Road Drag.
186	606	Collection and Preservation of Insects, etc.

The following Farmers' Bulletins which are given the general title, "Experiment Station Work," should be secured, as they contain many short but very interesting articles on nearly every phase of agriculture:

The listing of these articles in their proper place in the Bibliography will provide fascinating work for many students who might otherwise find time hanging heavy on their hands. Order by the following bulletin numbers: 56; 65; 69; 73; 78; 79; 84; 87; 92; 97; 103; 114; 119; 122; 133; 144; 149; 162; 169; 193; 202; 210; 222; 225; 227; 233; 237; 244; 251; 259; 262; 267; 273; 276; 281; 296; 305; 309; 316; 317; 320; 329; 334; 342; 453; 360; 366; 374; 381; 384; 388; 405; 412; 419; 425; 430; 435; 451; 457; 465; 469; 479; 486; 499; 504; 514; 517; 522; 527; 532;549.

BULLETINS

United State Department of Agriculture

(These are not "Farmers' Bulletins")

Key No.	Bull. No.	
186	20	Management of Sheep on a Farm.
187	21	The Commercial Fattening of Poultry.
188	28	Bulb Growing.
189	29	Economics of Orcharding.
190	47	Lessons from German Potato Growers.
191	49	Cost of Raising a Dairy Cow.
192	57	Water Supply, Plumbing and Sewage Disposal for.

Special References

Key No.	Bull. No.	
200	....	Farm Papers: One or two of the best in the State and the Breeders' Gazette, Hoard's Dairyman, Orange Judd Farmer, or other good papers published elsewhere should come to each school.
202	....	"The Oregon Farmer" and "The Oregon Almanac." These may be obtained from C. C. Chapman, Secretary Oregon State Immigration Commission.
204	....	Yearbooks. United States Department of Agriculture. (The yearbooks may be obtained free by writing to either United States Senator from Oregon, or to the Congressman from your district.

OREGON AGRICULTURAL COLLEGE EXTENSION PUBLICATIONS

Key No.	Bull. No.	
210	91	Insect Pests of Truck and Garden Crops.
211	200	Septic Tanks and Absorption Systems.
212	101	Feeding the Dairy Cow.
213	102	Raising the Dairy Calf.
214	105	Improving the Dairy Herd.
215	106	Farm Butter Making.
216	107	The Care of Milk and Cream.
218	108	Feeding Young Chickens.
219	109	Making the Babcock Test.
220	115	Planning and Planting the Garden.
221	116	Selecting and Caring for the Flock.
222	117	Feeding and Care of Dairy Cows.
223	118	Handling the Fruit Crop.
224	119	Feeding for Pork and for Show.
225	121	Growing an Oregon Potato Crop.
226	123	How and When to Spray the Orchard.
227	124	Corn in Oregon.
228	126	How to Conduct a Fly Campaign.
229	127	Breeds of Chickens.
230	128	Fruit and Vegetable By-Products.
231	156	Judging Dairy Cows.
232	157	Feeding for Eggs.
233	158	Incubation and Brooding.
234	159	Housing of Chickens.
235	160	Oregon Station Trap Nest.
236	162	Judging Swine.

OREGON EXPERIMENT STATION PUBLICATIONS

Key No.	Bull. No.	
240	112	Soils of Oregon.
242	....	Biennial Crop Pest and Horticultural Report.
244	Cir. 18	Swine Husbandry.
246	Cir. 8	Farming in Eastern Oregon.
248	117	Experimental and Demonstration Work in Eastern Oregon.
249	120	Improving Sandy Soils by Use of Green Manure Crops.
250	....	Directions for Collecting and Preserving Insects, Department of Entomology, O. A. C.

NOTE: The following list of publications is made up exclusively of United States Department of Agriculture Year Book Separates. Order by *Separate Number:*

Key No.	Separate No.	TITLE
300	19	Grain Smuts, Their Causes and Prevention.
301	29	Condition in Soils of Arid Regions.
302	47	Small Fruit Culture for Market.
303	50	Cause and Prevention of Pear Blight.
304	94	Utilization of By-Products of Dairy.
305	133	Birds as Weed Destroyers.
306	197	How Birds Affect the Orchard.
307	215	Commercial Pear Culture.
308	233	Rural School Problems.
309	260	Dairying at Home and Abroad.
310	266	Top Working Orchard Trees.
311	270	Practicability of Forest Planting in United States.
312	287	Improvement of Corn by Seed Selection.
313	293	Cultivation and Fertilization of Peach Orchards.
314	309	Economic Value of Bobwhite.
315	323	Model Farm.
316	324	Wheat Flour and Bread.
317	326	Macaroni Wheat.
317-A	329	Relation of Forests to Stream Flow.
318	340	Opportunities in Agriculture.
319	344	Relation of Birds to Fruit Growing in California.
320	349	Potato Culture.
321	360	Annual Loss Occasioned by Destructive Insects in the United States.
321-A	362	Boys' Agricultural Clubs.
322	364	Benefits Farmers Derive from Game Protection.
323	386	Principal Insect Enemies of Peach.
324	387	Handling of Fruit for Transportation.
325	388	Meadow Mice in Relation to Agriculture.
327	393	Relation of Irrigation to Dry Farming.
328	396	Farm Practice in Control of Field-Crop Insects.
329	416	Birds that Eat Scale Insects.
330	432	Opportunities for Dairying.
331	437	Plant Diseases in 1906.
332	438	Principal Injurious Insects of 1906.

Key No.	Separate No.	
333	443	Does It Pay the Farmer to Protect Birds?
334	444	Bacteria in Milk.
335	446	Art of Seed Selection and Breeding.
336	447	Value of Insect Parasitism to American Farmer.
337	452	Rabbit as Farm and Orchard Pest.
338	456	Cropping Systems for Stock Farms.
339	458	Use of Small Water Supplies for Irrigation.
340	459	Truck Farming in Atlantic States.
341	460	Codling Moth for Apple Worm.
342	463	Diseases of Ornamental Trees.
343	467	Plant Diseases in 1907.
344	472	Principal Injurious Insects of 1907.
345	474	Economic Value of Predaceous Birds and Mammals.
346	475	Wastes of the Farm.
347	480	Information About Spraying for Orchard Pests.
348	482	Mouse Plagues, Their Control and Prevention.
349	494	Development of Farm Crops Resistant to Disease.
350	495	Soil Mulches for Checking Evaporation.
351	499	Principal Injurious Insects of 1908.
352	502	Methods and Cost of Marketing.
353	504	Plants Useful to Attract Birds and Protect Fruit.
354	505	Problems of Irrigation Farmer.
355	506	Pocket Gophers as Enemies of Trees.
356	507	Functions and Value of Soil Bacteria.
357	509	Farming as Occupation for City-Bred Men.
358	511	Future Wheat Supply of United States.
359	514	Methods of Applying Water to Crops.
360	515	Progress in Methods of Producing Higher Yielding Strains of Corn.
361	517	Opportunities in Forest Planting for the Farmer.
362	518	Comforts and Conveniences in Farmers' Homes.
363	519	Prevention of Frost Injury to Fruit Crops.
364	520	Handling of Deciduous Fruits on Pacific Coast.
365	522	How Farmers May Utilize Special Warnings of Weather Bureau.
366	526	Agricultural Duty of Water.
367	530	Nitrogen-Gathering Plants.
368	545	Migratory Movements of Birds in Relation to Weather.
369	546	Cooperation in Handling and Marketing Fruit.
370	550	Pre-cooling of Fruit.
371	552	Effect of Present Method of Handling Eggs.
372	558	Reduction of Waste in Marketing.
373	559	Prevention and Treatment of Disease in Poultry.
374	561	Relation Between Rotation Systems and Insect Injury.
375	563	Important American Soils.
376	564	Bird Enemies of Codling Moth.
377	565	Some Misconceptions Concerning Dry Farming.
378	566	Tree Planting by Farmers.
379	567	Seasonal Distribution of Labor on Farm.
380	568	Some Results of Farmers' Cooperative Demonstration Work.

Key No.	Separate No.	
381	570	Irrigation in Humid Regions.
382	572	Rotation in Corn Belt.
383	574	Water Economy of Dry-Land Crops.
384	576	Present Outlook for Irrigation Farming.
385	577	Commercial Methods of Canning Meats.
386	583	Value of Predaceous Beetles.
387	584	Handling and Marketing of Eggs.
388	590	Our Meadow Larks in Relation to Agriculture.
389	591	Handling of Dressed Poultry.
390	594	Insects Injurious to Onion Crop.
391	595	Condensed and Dessicated Milk.
392	596	How to Improve Quality of Poultry and Eggs.
393	597	Successful Method of Marketing Vegetable Products.
394	599	Some Useful Weather Proverbs.
395	600	Some Important Insect Enemies of Livestock.
396	601	Relation of Birds to Grain Aphides.
397	606	Dairying and Its Relation to Agriculture in Semi-Arid Sections.

SUPPLEMENT TO BIBLIOGRAPHY

One or more of the following farm papers published in this State, and one or more of national circulation should come regularly to every school. School boards cannot spend $2.00 or $3.00 to better advantage than to have some good farm papers placed on the school reading-table.

Whenever the school cannot afford to subscribe for farm papers, the pupils should be encouraged to bring them from their homes.

The farm papers published in Oregon are as follows:

Pacific Northwest ..... Portland, Oregon
Pacific Rural Spirit ..... Portland, Oregon
The Oregon Agriculturist ..... Portland, Oregon
The Farm Magazine ..... Portland, Oregon
The Western Stock Journal ..... Oregon City, Oregon
Pacific Homestead ..... Salem, Oregon
The Oregon Farmer ..... Salem, Oregon
Northwest Poultry Journal ..... Salem, Oregon
The Farm, Orchard and Garden ..... Central Point, Oregon
Eastern Oregon Agriculturist ..... La Grande, Oregon
Northwest Pacific Farmer ..... Portland, Oregon
Better Fruit ..... Hood River, Oregon

Some of the best farm papers of national circulation that deal more or less with Oregon conditions are as follows:

The Breeder's Gazette, ... Chicago, Illinois
Hoard's Dairyman ..... Fort Atkinson, Wis.
Northwest Farmstead ..... Minneapolis, Minn.
The Fruit Grower and Farmer ..... St. Joseph, Mo.
The Country Gentleman ..... Philadelphia, Pa.